

S H O P

MANUAL

SEA-DOO®

SP 5876 SPX 5877 SPI 5878 GTS 5817

GTI 5865 • 5866 XP 5858 • 5859 HX 5881

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2 1 9 1 0 0 0 3 1



SEA-DOO®

SHOP MANUAL

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SAFETY NOTICE

This manual was primarily published to be used by watercraft technicians trained by the manufacturer who are already familiar with all service and maintenance procedures relating to Bombardier made Sea-Doo watercraft.

Please note that the instructions will apply only if proper hand tools and special service tools are used.

It is understood that this manual may be translated into another language. In the event of any discrepancy, the English version shall prevail.

The content depicts parts and / or procedures applicable to the particular product at its time of manufacture. It does not include dealer modifications, whether authorized or not by Bombardier, after manufacturing the product.

The use of Bombardier parts is most strongly recommended when considering replacement of any component. Dealer and / or distributor assistance should be sought in case of doubt.

Torque wrench tightening specifications must be strictly adhered to. Locking devices (ex.þ: locking disk, lock nut) must be installed or replaced with new ones, where specified. If the efficiency of a locking device is impaired, it must be renewed.

This manual emphasizes particular information denoted by the wording and symbolsþ;

◆ WARNING : Identifies an instruction which, if not followed, could cause serious personal injury including possibility of death.

▼ CAUTION : Denotes an instruction which, if not followed, could severely damage watercraft components.

○ NOTE : þIndicates supplementary information needed to fully complete an instruction.

Although the mere reading of such information does not eliminate the hazard, your understanding of the information will promote its correct use. Always use common shop safety practice.

This information relates to the preparation and use of Bombardier watercraft and has been utilized safely and effectively by Bombardier Inc. However, Bombardier Inc. disclaims liability for all damages and / or injuries resulting from the improper use of the contents. We strongly recommend that any services be carried out and / or verified by a highly skilled professional technician. It is understood that certain modifications may render use of the watercraft illegal under existing federal, provincial and state regulations.

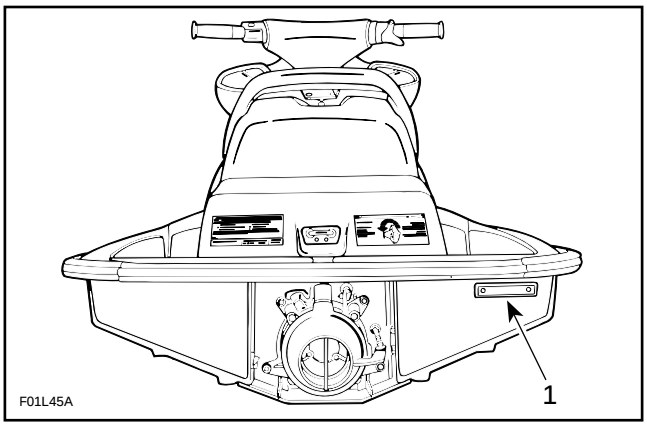
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INTRODUCTION

This Shop Manual covers BOMBARDIER made SEA-DOO® watercraft models SPþ5876, SPX 5877, SPI 5878, XPþ5858, HX 5881, GTSþ5817 and GTIþ5865þ/þ5866.

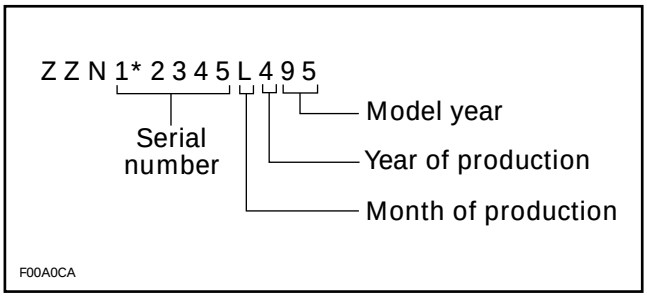
HULL IDENTIFICATION NUMBER (H.I.N.)

It is located at right rear side of hull.



1. Hull Identification Number (H.I.N.)

The Hull Identification Number is composed of 9 digitsþ:

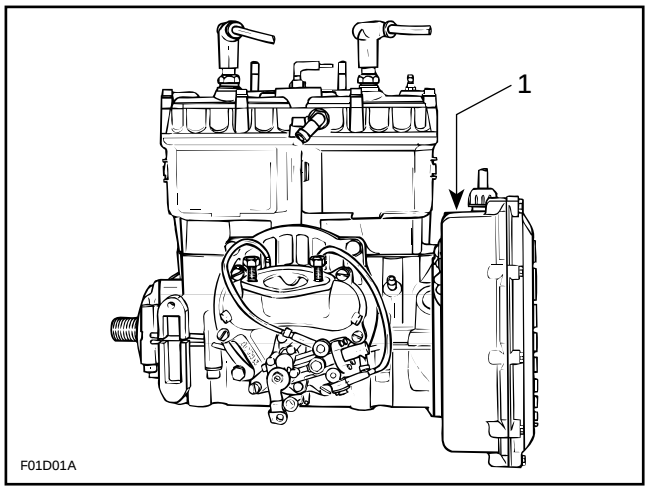


*This digit may be a number or a letter.

ENGINE IDENTIFICATION NUMBER (E.I.N.)

All Engines Except the 787

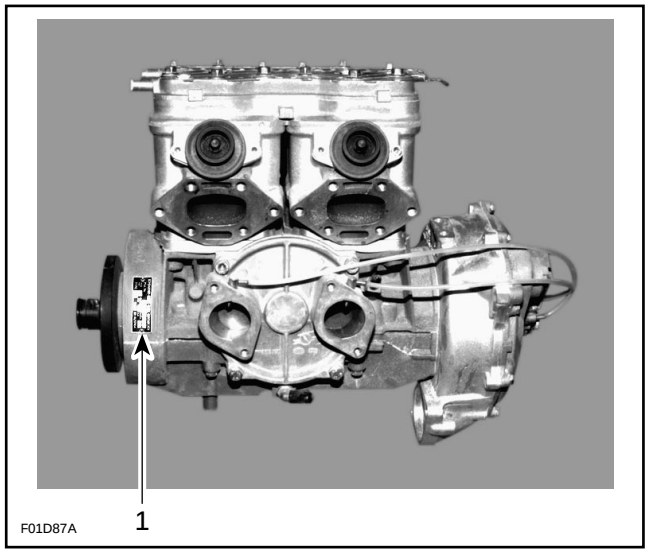
The Engine Identification Number is located on the upper side of the magneto housing.



1. Engine Identification Number (E.I.N.)

787 Engine Only

The Engine Identification Number is located on the upper side of the crankcase on PTO side.



1. Engine Identification Number (E.I.N.)

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ARRANGEMENT OF THIS MANUAL

The manual is divided into 14 major sectionsþ:

01SERVICE TOOLS AND PRODUCTS

02MAINTENANCE

03TROUBLESHOOTING

04ENGINE

05COOLING SYSTEM

06FUEL SYSTEM

07LUBRICATION SYSTEM

08ELECTRICAL SYSTEM

09PROPULSION SYSTEM

10STEERING SYSTEM

11SUSPENSION

12HULL / BODY

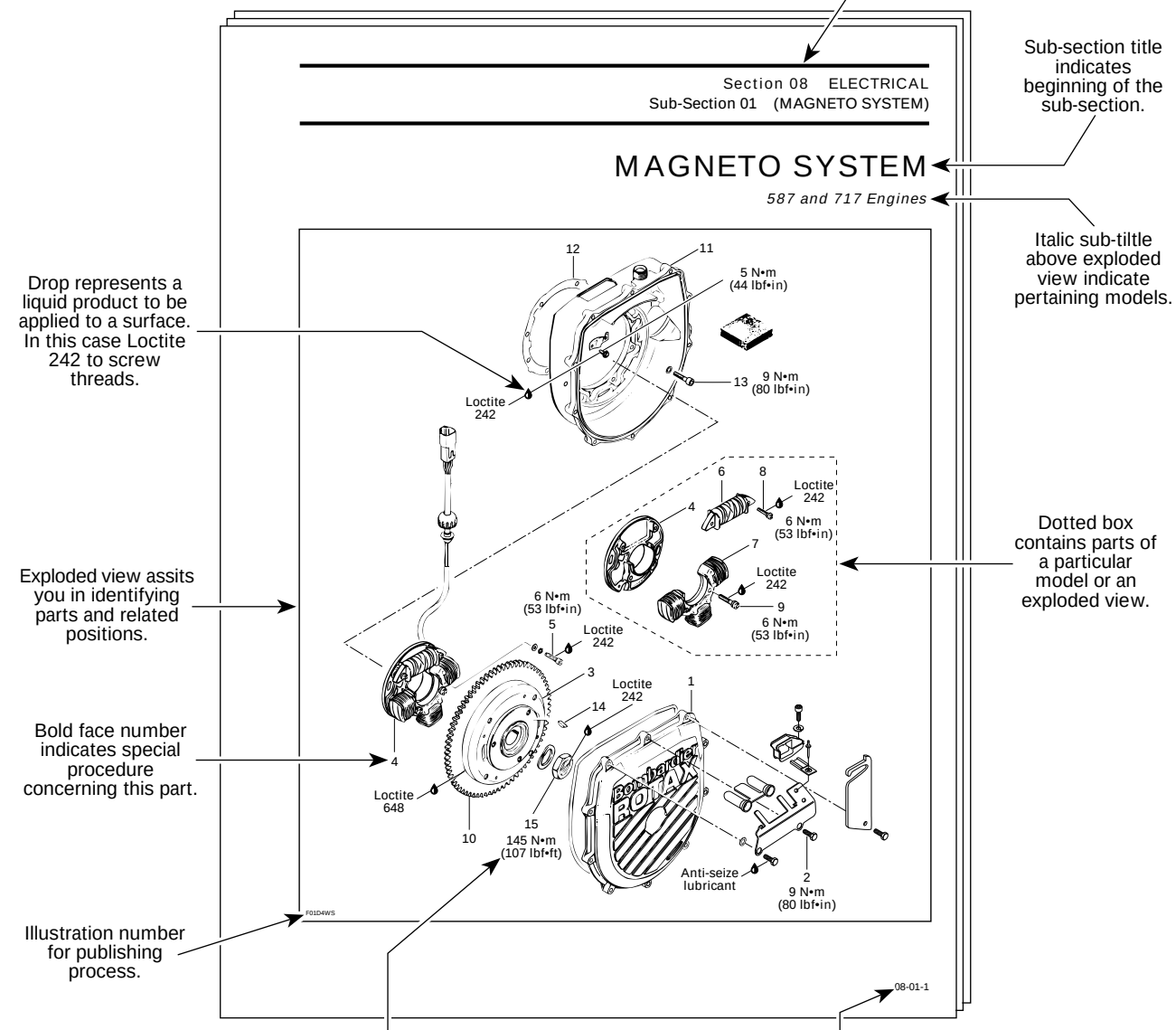
13TECHNICAL DATA

14WIRING DIAGRAMS

Several sections are divided in various sub-sections. There is a table of contents at the beginning of many sections.

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TYPICAL PAGE



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TYPICAL PAGE

Sub-title beginning with part number(s) of above exploded view following by part name(s).

Title indicates main procedure to be carried-out.

CARBURETOR REMOVAL

To remove carburetors from engine, proceed as follows :

Remove air vent tube support.

Unlock retaining slides holding air intake silencer base. Remove air intake silencer base from watercraft.

Remove screws holding flame arrester base support to cylinder head cover.

Unscrew base retaining screws then remove base from carburetors and move to front of watercraft.

Turn the valve to OFF position.

Service tool to be used to perform a certain procedure.

NOTE : For fuel line removal, use pliers (P/N 295 000 054).

Disconnect pulse line from fuel pump.

Disconnect fuel fuel supply line from fuel pump.

Disconnect fuel return line.

Disconnect oil injection pump cable, throttle cable and choke cable.

Sub-sub title in italic indicates a particular procedure concerning a model.

XP Model Only

Remove screws and lock washers retaining carburetors.

Remove carburetors from intake manifold.

Sub-sub-title in this case indicates that particular procedure for XP is finished, so from this point, all others models are concerned.

All Others Models

Remove 4 bolts and lock washers from rotary valve cover then move carburetors and rotary valve cover on top of engine.

NOTE : When removing rotary valve cover , pay attention that the rotary valve stay in place, otherwise it must be timed.

Remove carburetors from intake manifold.

Disconnect fuel bypass line between carburetors (twin carburetors).

Remove carburetor(s) from rotary valve cover.

DISASSEMBLY AND INSPECTION

Inspect parts for corrosion dammage (shaft, butterfly, spring, screw, check valve housing, etc.).

3, Diaphragm

PUMP DIAPHRAGM LEAK TEST

Sub-sub-title in capital indicates a particular testing, adjustment or repair procedure.

Using a suitable pump gauge tester, perform the following test proceeding as follows :

- Install pump gauge tester (P/N 295 000 083) on pulse nipple.
- Pump tester until it reaches 28 kPa (4 PSI).

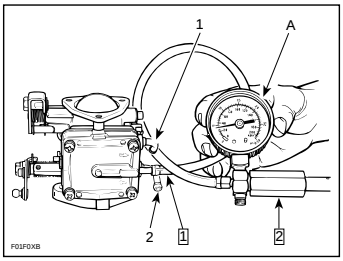


Illustration always follows text it is pertained to.

''TYPICAL''mention indicates a general view which does not represent full detail.

TYPICAL

Step 1 : Install pump gauge tester to pulse nipple
Step 2 : Pump tester until it reaches the desired pressure
1. Fuel outlet nipple
2. Fuel inlet nipple
A. 28 kPa (4 PSI)

Diaphragm must stand pressure for 10 seconds. If pressure drops, replace diaphragm.

Numbers in a frame are used to give a sequence to be perfomed.

Letters are used for any measures.

Numbers are used for desciption of components.

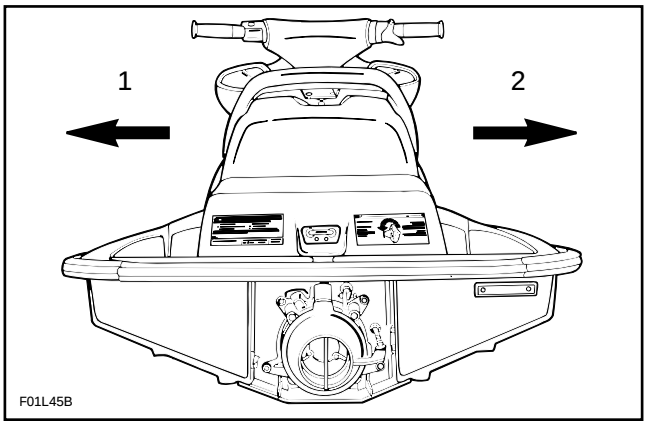
06-03-4

F01A0AS

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GENERAL INFORMATION

The use of RIGHT and LEFT indications in the text, always refers to driving position (when sitting on watercraft).



1. Left (port)
2. Right (starboard)

The information and component / system descriptions contained in this manual are correct at time of publication. Bombardier Inc. however, maintains a policy of continuous improvement of its products without imposing upon itself any obligation to install them on products previously manufactured.

Bombardier Inc. reserves the right at any time to discontinue or change specifications, designs, features, models or equipment without incurring obligation.

This Shop Manual uses technical terms which may be different from the ones of the Parts Catalogs.

When ordering parts always refer to the specific model Parts Catalogs.

PARTS CATALOGS	
MODELS	P/N
SP (5876) SPX (5877) SPI (5878)	219 300 180
GTS (5817) GTI (5865/5866)	219 300 210
XP (5858)	219 300 200
HX (5881)	219 300190

ILLUSTRATIONS AND PROCEDURES

The illustrations show the typical construction of the different assemblies and, in all cases, may not reproduce the full detail or exact shape of the parts shown, however, they represent parts which have the same or a similar function.

▼ CAUTION : These watercraft are designed with parts dimensioned in both the metric and the imperial systems. When replacing fasteners, make sure to use only those recommended by Bombardier. Mismatched or incorrect fasteners could cause damage to the watercraft or possible personal injury.

As many of the procedures in this manual are interrelated, we suggest, that before undertaking any task, you read and thoroughly understand the entire section or sub-section in which the procedure is contained.

A number of procedures throughout the book require the use of special tools. Before undertaking any procedure, be sure that you have on hand all the tools required, or approved equivalents.

Technical Publications
Bombardier Inc.
Valcourt (Quebec), Canada

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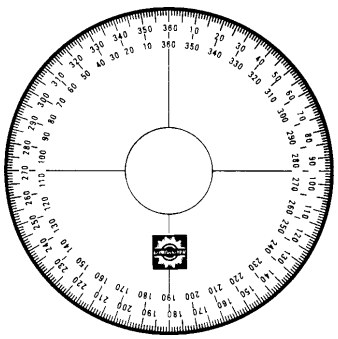
MANDATORY TOOLS

NOTE : The numbers outlined in black (example : ❑) are reference numbers to tools from other divisions (Sea-Doo and/or Sea-Doo Jet Boats). Matching reference numbers indicate the same tool is being used on both products, even if the part numbers are different:

ENGINE

Degree wheel **1**

P / N 295000007



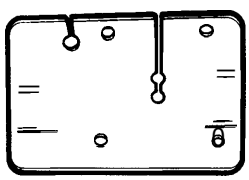
AOOB334

APPLICATION

All models.

Rubber pad **547**

P / N 295000101



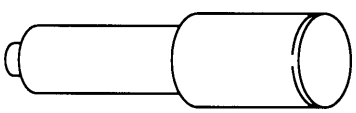
FOIBOJA

APPLICATION

All models.

Bearing pusher **12**

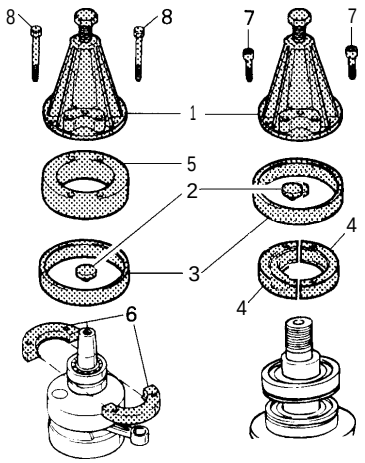
P / N 290876500



A00B2J4

APPLICATION

All models.



'01 D884

1) Puller **200**

P / N 290876298

2) Protective cap (both ends) **554**

P / N 290876557

3) Ring (both ends) **555**

P / N 290977490

4) Ring halves (PTO) **556**

P / N 290977475 (2)

5) Distance ring (MAG) **557**

P / N 290876569

6) Ring halves (MAG) **558**

P / N 290276025 (2)

7) Screw M8 x 40 **559**

P / N 290840681 (2)

8) Screw M8 x 70 **560**

P/N 290841201 (2)

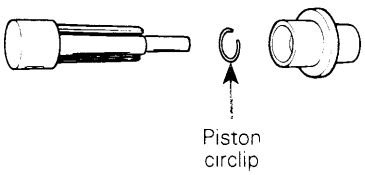
APPLICATION

All models.

Piston circlip installer

A) P / N 295000077 **202**

B) P / N 290877016 **548**



A01B1P4

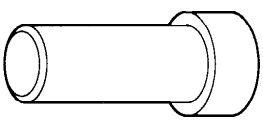
APPLICATION

A) 587 engine.

B) 657, 717 and 787 engines.

Pusher **229**

P / N 290876605



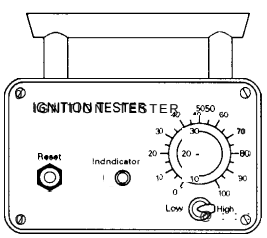
A00C0Y4

APPLICATION

All engines except 787.

Bombardier ignition tester **236**

P / N 295000008



A00C1K4

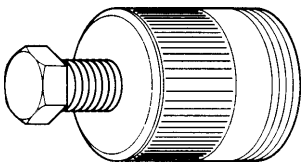
APPLICATION

All models.

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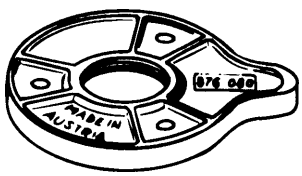
ENGINE (continued)

Puller
P / N 295000106



AOOC1A4

Puller plate **549**
P / N 290876080



A00C1R4

Extension handle **550**
P / N 295000125



FO1 D164

Screw M8 x 35 (3) **551**
P / N 290841 591



FOOA094

Sleeve (3) **552**
P / N 290847220

0
0

FOOAOA4

APPLICATION
All models

PTO flywheel remover/ installer **553**
P / N 295000001

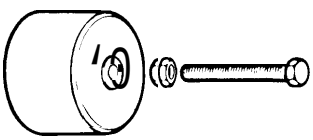
m

F01JOT4

APPLICATION
All models.

0 NOTE : This tool is also used for the impeller.

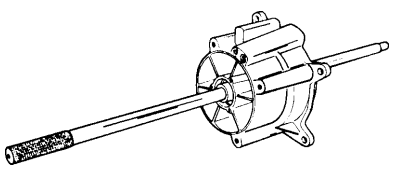
Puller **562**
P / N 290876488



F01B0I4

APPLICATION
All engines.

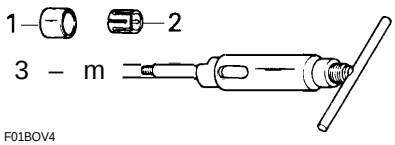
A) Alignment tool support P / N 295000090 **563**
B) Alignment shaft P / N 295000093 **571**
C) Alignment shaft P / N 295000141 **570**



F01L2R4

APPLICATION
A) All models.
B) All models except HX.
C) l-lx.

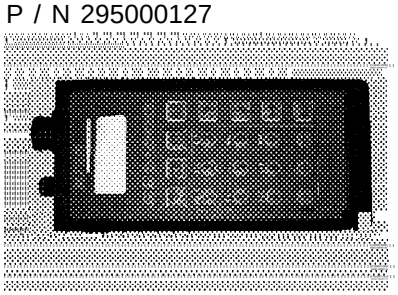
Piston pin puller
A) P/N 290877092 **566**
B) P/N 295000105 **565**



F01BOV4

APPLICATION
A) 657, 717 and 787 engines
Replacement parts :
1. Locating sleeve **772**
P / N 290877181
2. Expansion sleeve **771**
P / N 290877041
3. Extracting nut **770**
P / N 290877155
B) 587 engine
Replacement parts :
1. Locating sleeve **769**
P / N 295000118
(2)
2. Expansion sleeve **768**
P / N 295000117
(2)
3. Extracting nut (2) **767**
P / N 295000115

MPEM programmer **567**
P / N 295000127



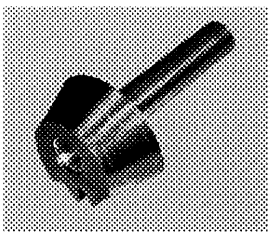
F01B254

APPLICATION
787 engine.

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ENGINE (continued)

Ring gear blocking tool **568**
P / N 295000134



F01B264

APPLICATION
787 engine.

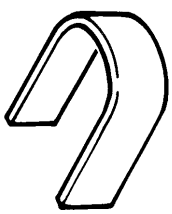
Ring gear puller tool **569**
P / N 420976235



F01B294

APPLICATION
787 engine.

Distance gauge **561**
P / N 290876826



FO1 BOH4

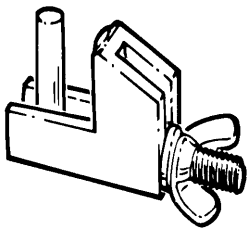
APPLICATION
587 and 657 engines.

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COOLING / FUEL/ OIL SYSTEMS

Hose pincher **2**

P/ N 295000076



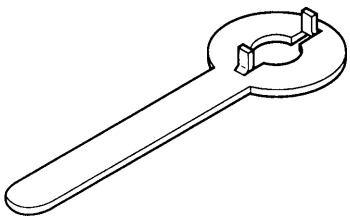
AO1 B214

APPLICATION

All models.

Gear holder **235**

P/N 290277 905



AOOC164

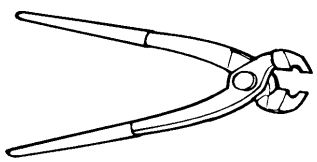
APPLICATION

717 engine,

Pliers **601**

p,/ N 29.5 000070

Oetiker 1099



F01 D174

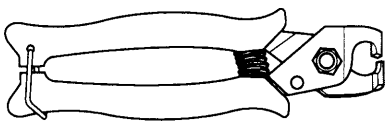
APPLICATION

All models.

Pliers **C06**

P / N 295000054

Caillau



F01B1T4

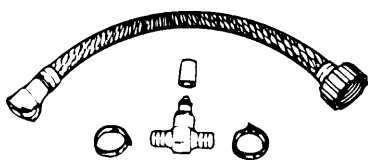
APPLICATION

All models.

0 NOTE : This tool is also used for the propulsion system.

Flush kit **564**

P / N 295500068



F01E014

APPLICATION

587, 717 and 787 engines.

Coupler hose **752**

P / N 295500258

41 cm (16 in)



F01EOZ4

APPLICATION

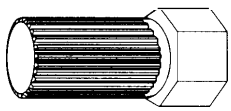
All models.

www.SeaDooManuals.net

PROPULS1ON SYSTEM

Impeller remover / installer **553**

P / N 295000001



F01J0T4

APPLICATION

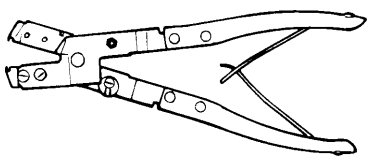
All models.

NOTE : This tool is also used for the PTO flywheel.

Pliers **C02**

P / N 295 000069

Oetiker 1090



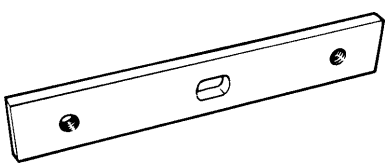
FO1 D184

APPLICATION

All models.

Impeller shaft holder **603**

P / N 295000082



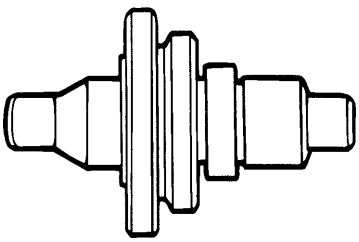
F01B0W4

APPLICATION

All models.

Bearing / seal installer **C04**

P / N 295000107



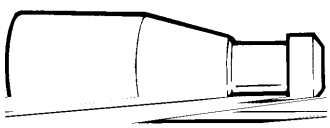
F01J4K4

APPLICATION

All models.

Impeller shaft guide **605**

P /N 295 000 002



FO1J1O4

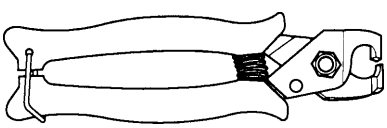
APPLICATION

All models.

Pliers **C06**

P / N 295000054

Caillau



F01B1T4

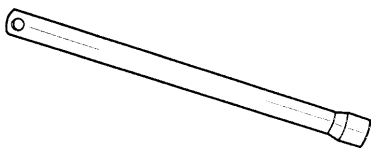
APPLICATION

All models.

NOTE : This tool is also used for the fuel system.

VTS tool **607**

P/' N 295000133



F01B2P4

APPLICATION

XP 1995 and 1996 models.

XP 8001995 model.

SPX 1996 model.

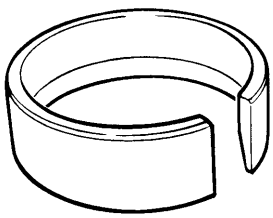
www.SeaDooManuals.net

RECOMMENDED TOOLS

NOTE : The numbers outlined in black (example : ❑) are reference numbers to tools from other divisions (Sea-Doo and/or Sea-Doo Jet Boats). Matching reference numbers indicate the same tool is being used on both products, even if the part numbers are different.

ENGINE

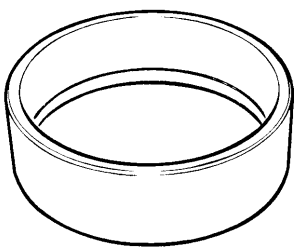
Ring compressor **766**
P / N 290876979



AO1 B1T4

APPLICATION
717 and 787 engines (82 mm).

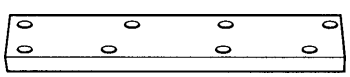
Coil centering tool **209**
P / N 290876922



A01B1V4

APPLICATION
717 engine.

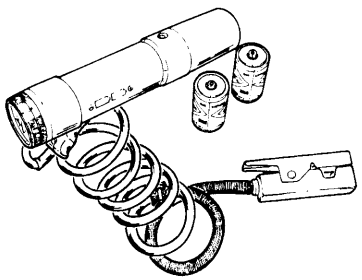
Cylinder aligning tool **220**
P / N 290876904



A00B084

APPLICATION
All models.

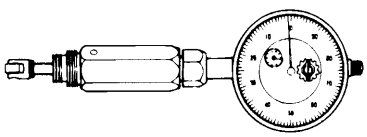
Stroboscopic timing light **225**
P / N 295000078



A01B2K4

APPLICATION
All models.

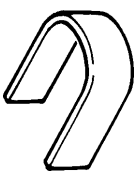
Dial indicator **230**
(TDC gauge)
P / N 295000143



AOOB2E4

APPLICATION
All models.

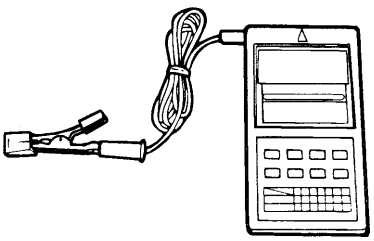
Distance gauge
A) P / N 290876827
B) P / N 290876828 **760**



F01B0H4

APPLICATION
A) 717 engine.
B) 787 engine.

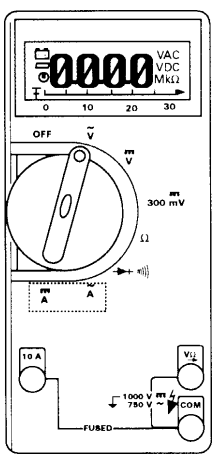
Digital / induction type tachometer **237**
P / N 295000100



F01B1G4

APPLICATION
All models.

Digital multimeter **242**
P / N 529022000



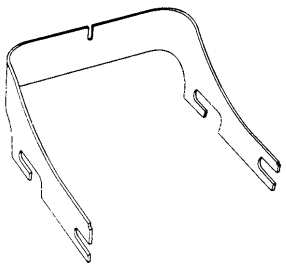
FO1B1O4

APPLICATION
All models.

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ENGINE (continued)

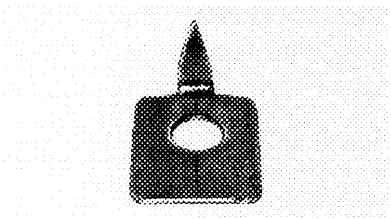
Timing mark pointer **774**
P / N 295000130



FO1 B204

APPLICATION
All engines except 787.

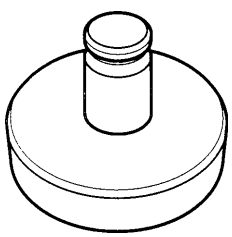
Timing mark pointer **754**
P / N 295000135



F01H544

APPLICATION
787 engine.

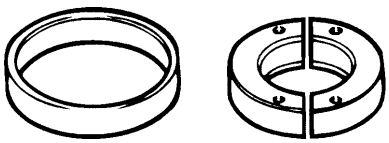
Oil seal pusher **759**
P/ N 290877740



F01B2C4

APPLICATION
787 engine.

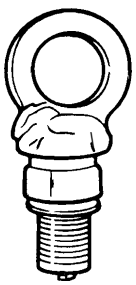
Ring halves and ring
P / N 290876330 (halves) (2) **761**
P / N 2909774 (ring) **762**



F01B2D4

APPLICATION
787 engine

Engine lifting device
Not sold by Bombardier
Do it yourself
Refer to *Shop Manual* section 04-01

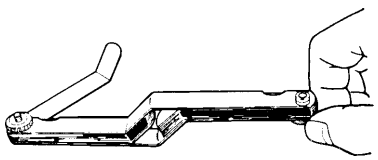


F01D0A4

APPLICATION
All models except 787

Feeler gauge 45°
Not sold by Bombardier

Snap-on
FB 300A

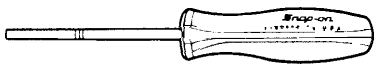


F01B1K4

APPLICATION
All models

Terminal remover
Not sold by Bombardier

Snap-on
TT 600-4

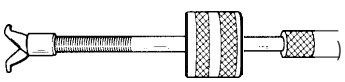


F01B1J4

APPLICATION
All models.

Slide hammer puller
Not sold by Bombardier

Snap-on Handle CJ93-1
Hammer CJ1 25-6
Claws CJ93-4



F01J0Z4

APPLICATION
All models.

NOTE : This tool is also used to pull out impeller shaft seal.

Protective mat **889**
P / N 295000128



F04L1V4

APPLICATION
All models.

www.SeaDooManuals.net

ENGINE (continued)

Safety lanyard switch tool **775**
P / N 295000121

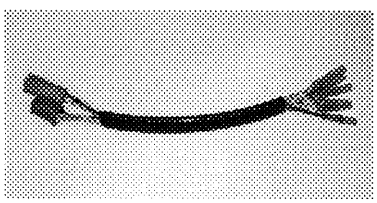


F01B244

APPLICATION
DESS switch.

A) Four-pin magneto harness **763**
P / N 295000131

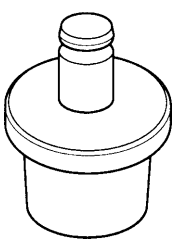
B) Six-pin magneto harness **755**
P / N 295000136



F01B284

APPLICATION
A) 587, 657 and 717, 1995 and newer.
B) 787 engine.

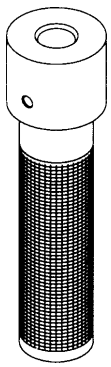
Rotary valve shaft pusher **757**
P / N 290876609



F01B2B4

APPLICATION
787 engine.

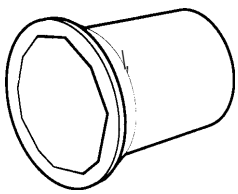
Handle **758**
P / N 290877650



AOOC3V4

APPLICATION
787 engine.

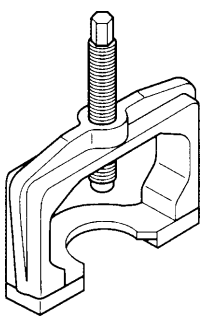
Exhaust outlet tool **831**
P / N 295000132



F01B2A4

APPLICATION
Exhaust nut on transom.

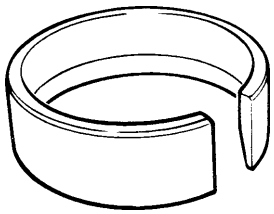
Gear/ bearing puller **765**
P / N 290877665



F04B034

APPLICATION
787 engine.

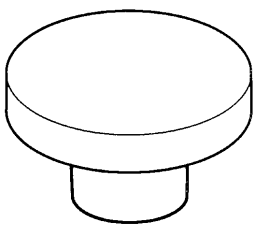
Ring compressor
A) P / N 290876972 **207**
B) P / N 295000112 **751**



A01B1T4

APPLICATION
A) 587 engine (76 mm).
B) 657 engine (78 mm).

Crankshaft protector **764**
P / N 420876552



FOOB034

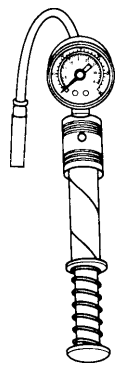
APPLICATION
For use with pullers.

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COOLING / FUEL/ OIL SYSTEMS

Pump gauge tester (carburetor **826**

P / N 295000114



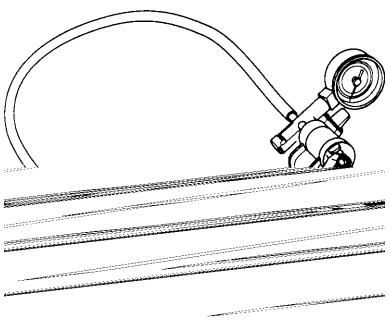
F01B0X4

APPLICATION

All models.

Pump gauge tester (fuel / oil reservoirs) **827**

P / N 295000085



F01B0Y4

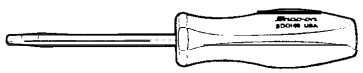
APPLICATION

All models.

Screwdriver

Not sold by Bombardier

Snap-on
SDD-143



F01B1P4

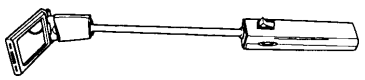
APPLICATION

All models.

Lighted adjustable mirror

Not sold by Bombardier

Snap-on
50101



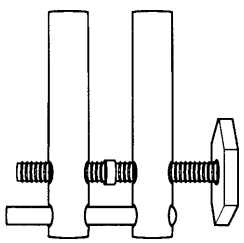
F01B114

APPLICATION

All models.

Hose pincher **773**

P / N 529030400



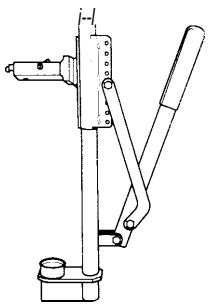
F01B234

APPLICATION

All engines.

Spring compressor

P / N 529027100



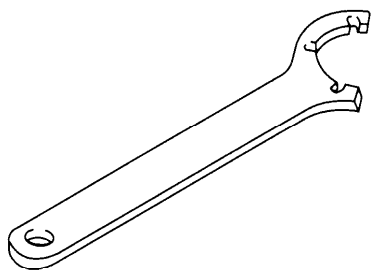
A01B404

APPLICATION

HX.

Suspension adjustment wrench **833**

P / N 529012200



A25A014

APPLICATION

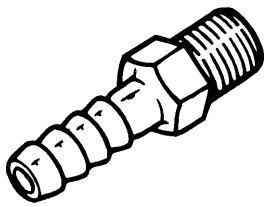
HX seat suspension.

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PROPULSION SYSTEM

Fitting **828**

P / N 295000086



F01 BOZ4

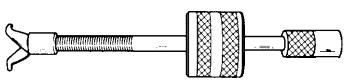
APPLICATION

All models.

Slide hammer puller

Not sold by Bombardier

Snap-on Handle CJ93-1
Hammer CJ1 25-6
Claws CJ93-4



F01J0Z4

APPLICATION

All models.

NOTE : This tool is also used to remove rotary valve shaft bearing.

Hacksaw

Not sold by Bombardier

Snap-on
HS3



F01B1M4

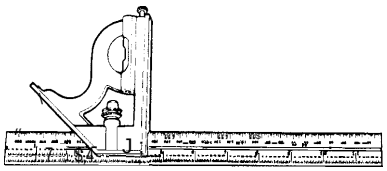
APPLICATION

All models.

Machinist's square

Not sold by Bombardier

Snap-on
PMF122



F02B064

APPLICATION

Models equipped with reverse.

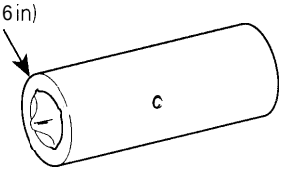
Fitting remover

Not sold by Bombardier

Do it yourself

Refer to *Shop Manual* section 09-01

Deep socket
14 mm
(9/16 in)



F01J2RA

APPLICATION

All models.

Bearing remover

P / N 295000144



F01J114

APPLICATION

All models.

Flexible spout (oil) **834**

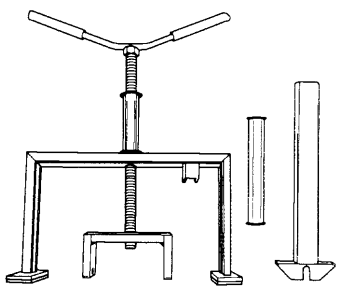
P / N 414837300

APPLICATION

All models.

Impeller housing remover **829**

P / N 295000113



F01L2O4

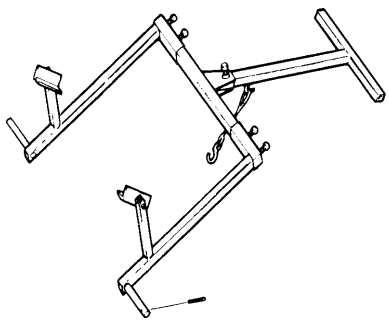
APPLICATION

All models.

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WATERC RAFT HANDING

Dolley (with wheels) **876**
P / N 295000126



F01B014

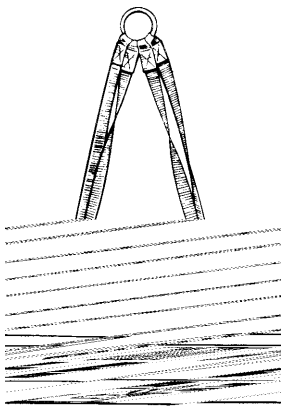
Beach wheels (2) **877**
P / N 295000005



F01B074

APPLICATION
All models.

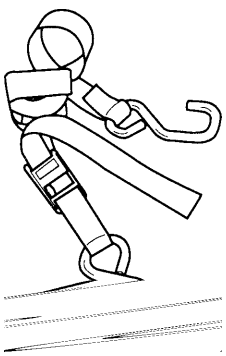
Lift kit
A) P / N 295100012 **879**
B) P / N 295100 013 **880**



F01B1N4

APPLICATION
A) SP and XP series.
B) GTS and GTX models.

Tie-down **884**
1.50 m (5 ft) long
P / N 295100010



FOOB014

APPLICATION
All models.

Tie-down with ratchet **885**
3.60 m (12 ft) long
P / N 295100 011

APPLICATION
All models.

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SERVICE PRODUCTS

NOTE : The numbers outlined in black (example : ❑) are reference numbers to tools from other divisions (Sea-Doo and/or Sea-Doo Jet Boats). Matching reference numbers indicate the same tool is being used On both products, even if the part numbers are different.

154 Medium strength thread locker

P / N 293800015

Loctite 242 (blue)
(10 mL)



AOOB324

APPLICATION

Cylinder head screws (All engines).

Tuned pipe nut and screws.

Engine rubber mount screws.

Armature plate screws.

Magneto flywheel / crankshaft.

Carburetor mount nuts / screws.

Magneto coil screws.

Impeller housing cover screws (except for plastic pumps).

Venturi / impeller housing screws.

Intake grate screws.

Engine support screws.

Impeller housing / hull nuts.

Steering nozzle screws.

Reverse gate screws.

155 High strength thread locker

P / N 293800005

Loctite 271 (red)
(10 mL)



A00B2U4

APPLICATION

Impeller shaft thread.

359 High temperature threadlocker

P / N 290899788

Loctite 648 (green)
(5 g)



APPLICATION

Crankcase / plug at end of rotary valve shaft.

Magneto / ring gear.

959 Assure

P / N 293800039

Loctite 642
(50 mL)



FOOB024

APPLICATION

Press fit parts on crankshafts.

151 Retaining compound

P / N 413703100

Loctite® RC / 609 (green)
(10 mL)



A00B2SA

APPLICATION

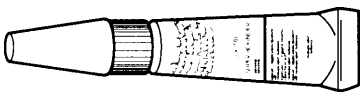
Used for retaining bushings, bearings in slightly worn housing or on shaft.

www.SeaDooManuals.net

General purpose instant adhesive **373**

P / N 293800021

Loctite 495



AOOB2VA

APPLICATION

Rubber to metal bonding and most hard plastic.

Gasket stripper **935**

P / N 295000110 (500 mL)



F01B1W4

APPLICATION

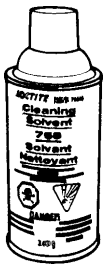
Mating surfaces of cylinders and crankcase.

Crankcase halves.

Solvent **157**

P / N 293800019

Loctite Safety Solvent 755 (12 Oz!



AOOB3M4

APPLICATION

Impeller shaft threads.

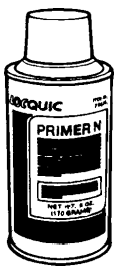
Drive shaft splines.

Impeller threads and splines.

Primer for gasket eliminator **158**

P / N 293600013

Loctite Locquic Primer N (170 mL)



AOOB3N4

APPLICATION

Crankcase halves mating surface.

Impeller shaft thread.

Venturi / impeller housing mating surface.

Gasket eliminator **152**

P / N 293800007

Loctite 515 (50 mL)



AOOB2T4

APPLICATION

Cylinder sleeve / O-ring groove.

Crankcase halves mating surface.

Crankcase screws.

Gasket eliminator **376**

P / N 293800038

Loctite 518 (50 mL)



F01B124

APPLICATION

Impeller housing cover.

Venturi / impeller housing.

Impeller shaft seal.

Pipe sealant

A) P / N 293800018 **358**

B) P / N 293800013 **360**

A) Loctite 592 (50 mL)

B) Loctite 567 (250 mL)



AOOB2W4

APPLICATION

Plug on impeller housing cover.

Plastic fitting tool (P/ N 295000 086) on impeller housing cover.

Cooling system fittings.

www.SeaDooManuals.net

Hylomar sealant **369**

P / N 293800001

PL32
'100g)



A00B3F4

APPLICATION

Sealant **919**

P / N 293530011

Sikaflex 221
(350 mL)



FO1 B1D4

APPLICATION

Sikaflex primer 449 **918**

P / N 293530012

(475 mL)



F01B1E4

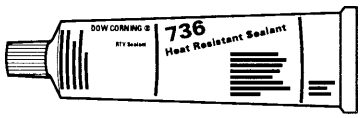
APPLICATION

For use with Sikaflex 221 sealant.

Heat resistant sealant **374**

P / N 413709200

Dow Corning 736
(90 m L)



A00B3U4

APPLICATION

Tuned pipe.

Sealant **961**

P / N 413710300

Loctite 179
(80 mL)

APPLICATION

Exhaust system 787 engine.

Epoxy glue

Not sold by Bombardier

3M-05900

APPLICATION

All models.

Gun Kote

Not sold by Bombardier

Kal-Gard
Coating & Mfg Corp

APPLICATION

Magneto and armature plate.

Dielectric grease **350**

P / N 293550004

Dow Corning
(**150** g)



F01B164

APPLICATION

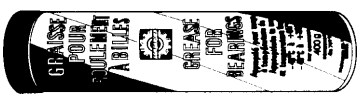
Battery posts and cable connectors.

Thermosensor switch.

Grease **924**

P / N 293550005

(400 g)



A00B2L4

APPLICATION

PTO flywheel.

Superlube grease **932**

P / N 293550014



AOOB474

APPLICATION

www.SeaDooManuals.net

Lubricant

Not sold by Bombardier

G E. Versilube
G341 M



or
Esso Beacon 325

AOOB1T4

APPLICATION

Sliding surface of starter armature shaft splines.

Synthetic grease **912**

P / N 293550010

(400 g)



F01B154

APPLICATION

Cylinder and cylinder head screws.

Carburetor linkage.

Impeller shaft seal lips.

Drive shaft / impeller splines.

PTO flywheel.

Anti-seize lubricant **362**

P / N 293800023

Loctite anti-seize
lubri cant
12 Oz (454 g)



F01B174

APPLICATION

Crankshaft thread / PTO flywheel.

Crankshaft bearing seat.

Spark plug threads.

Ignition housing cover screws.

Bombardier lube **913**

P / N 293600016

(12 x 14 oz)



F01BOS4

APPLICATION

Throttle cable.

Wear ring (when new).

Corroded parts.

Water flooded engine.

Storage.

Sea-Doo fuel stabilizer **375**

P / N 413408600

(8 oz)



AOOB3V4

APPLICATION

Fuel system.

Bombard ier-Rotax injection oil **915**

P/N 413802900 (12 X 1 L)



F01B184

APPLICATION

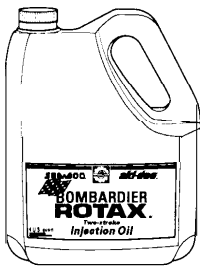
All models.

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Bombard ier-Rotax injection oil

P / N 413803000 (3x 4 L) **916**

P / N 413803200 (205 L) **962**



F01B2H4

APPLICATION

All models.

Bombardier-Rotax Formula XP-S synthetic injection oil

P / N 413711000 (3 X 4 L)

P / N 413710700 (205 L)



F01B354

APPLICATION

All models.

Bombardier-Rotax Formula XP-S synthetic Injection oil **937**

P / N 413710500 (12 X 1 L)



F01B2GA

APPLICATION

All models.

Jet pump 011 **914**

P/N 293600011 (12 X 6 OZ)

Sea-Doo synthetic jet pump 011



F01BOP4

APPLICATION

All models.

A) Silicone "Ultra Black" **901**
P / N 293800030

B) Silicone **902**
"Ultra Black FIB"
P / N 293800028

Loctite 598 (300 mL)



F01B1A4

APPLICATION

Ride shoe.

Jet pump fittings.

732 Multi-purpose sealant **917**

P / N 293800006

Dow Corning (90 mL) (clear)



F01B1C4

APPLICATION

Ride shoe screws.

Sealant adhesive **934**

P / N 293800033

Adchem 4511 (clear)



F01B1S4

APPLICATION

Ride shoe screws.

Sponson.

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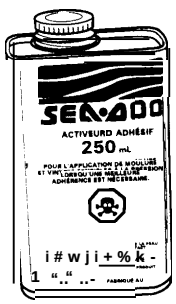
Sealant **936**
P / N 293800029

Tremco clear
(300 mL)

APPLICATION

Adhesive activator **931**
P / N 293530036

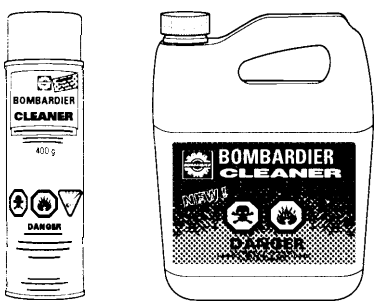
(250 mL)



F01B1Z4

APPLICATION
Decals,

Sea-Doo Cleaner
P/N 293110001 (400 g) **946**
P / N 293110002 (4 L) **947**



F01B2J4

APPLICATION
All models.

Spray paint for metallic parts only

A) White (140 g) **926**
P / N 293500029

B) Purple (140 g) **930**
P / N 293500020

C) Yellow(140 g) **925**
P / N 293500008

D) Charcoal (140 g) **927**
P / N 293500030

E) Grey (140 g) **928**
P / N 293500009

F) Blue **929**
P / N 293500014

G) Green **952**
P / N 293500061

H) White **956**
P / N 293500082

1) Blue /Violet **957**
P / N 293500077

Sea-Doo
paint



F01B0Q4

APPLICATION
A) Engine assembly 1995.
B) Tuned pipe and muffler 1995.
C) —
D) —
E) —
F) —
G) —
H) —
1) —

SMC spray paint

A) Violet **941**
P / N 293500068

B) Yellow (140 g) **949**
P / N 293500078

C) Lavender (140 g) **950**
P / N 293500 059

D) Magenta (140 g) **951**
P / N 293500060

E) Blue (140 g) **955**
P / N 293500073

Sea-Doo paint for SMC



F01B0Q4

APPLICATION
Storage cover.
A) GTS 1994.
B) GTI 1996.
C) GTS 1992-1993.
D) GTX 1992-1993.
E) GT 1991.

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Sea-Doo spray paint for gelcoat

A) Super white (140 g) **933**
P / N 293500076

B) Teal **940**
P / N 293 500 063

C) Green (140 g) **939**
P / N 293500062

D) Turquoise **953**
P / N 293500066

E) Light grey **954**
P / N 293500067

F) Grey (140 g) **920**
P / N 293500040

G) White (140 g) **921**
P / N 293500041

H) Purple (140 g) **922**
P / N 293500042

1) Rhodamine (140 g **968**
P / N 293500083



F01B1Q4

APPLICATION

A) All models 1995.

B) SPX 1995.

C) –

D) —

E) —

F) —

G) —

H) —

I) —

Gelcoat (liquid)

A) Super white (1 L) **943**
P / N 293500075

B) White (1L) **906**
P / N 293500033

C) Mauve (1 L) **907**
P / N 293500034

D) Grey (1 L) **908**
P / N 293500035

E) Light grey **909**
P / N 293500037

F) Green (1 L) **910**
P / N 293500038

G) Turquoise (1 L) **911**
P / N 293500039

H) Teal (1 L) **938**
P / N 293500069

I) Yellow **963**
P / N 293500081

APPLICATION

A) —

B) —

C) –

D) —

E) —

F) —

G) —

H) SPX.

I) —

Gelcoat repair kit

A) P / N 295500216 **945**

B) P / N 295500340

C) P / N 295500100 **904**

D) P / N 295500009 **903**



F01B0R4

APPLICATION

A) All 1995 models

B) —

C) 1993 and 1994 models

D) 1992 and prior models

Gelcoat paste (white) **905**

P / N 293500016

(1 0 oz)



F01B1F4

APPLICATION

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STORAGE 02-04-1

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PERIODIC INSPECTION CHART

NOTE : Servicing period is given in hours. Shaded area shows the maintenance frequency .

DESCRIPTION	FREQUENCY			
	Every 10 hours	Every 25 hours	Every 50 hours	Every 100 hours or seasonally
Lubrication / corrosion protection of metallic components	①			
Engine ignition timing				
Spark plug replacement				
Throttle / choke cables, inspection / lubrication	①			
Flame arrester inspection				
Carburetor adjustment including choke / throttle cable adjustments and linkage				
Oil injection pump adjustment				
Fuel filter and oil filter inspection				
Fuel filter and oil filter replacement				
Engine head bolts, retorque				
Steering system				
Reverse system / reverse cable adjustment (GTS / GTI)				
Variable trim system (SPX / XP)				
Fastener tightening (flame arrester support, carburetor(s), engine mount, exhaust system, etc).				
Muffler, battery and reservoir fastening devices				
Fuel / oil lines, check valve and hose inspection, fuel system pressurization				
Fuel / vent line pressure relief valve inspection				
Inspect / clean engine drain hose	①			
Water tank trap drain inspection (GTS / GTI)				
Bailer pick up inspection				
Battery condition				
Electrical connections (starter, battery, etc.)				
Monitoring beeper				
Impeller shaft reservoir oil level / oil condition				Replace
Impeller condition and impeller / wear ring clearance		②		
Drive shaft boot / spline condition (both ends)		②		
PTO flywheel and mid bearing (HX model only) lubrication				
Water intake grate condition		②		
Hull condition				
Cooling system flushing	③			

① Every 10 hours in salt water use.

② These items have to be initially checked after 25 hours. Thereafter, servicing to be made as specified in this chart.

③ Daily flushing in salt water or foul water use.

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FLUSHING AND LUBRICATION

GENERAL

Flushing the cooling system with fresh water is essential to neutralize corroding effects of salt or other chemical products present in water. It will help to clean up sand, salt, shells or other particles in water jackets (engine, exhaust manifold, tuned pipe) and / or hoses.

Flushing and engine lubrication should be performed when the watercraft is not expected to be used further the same day or when the watercraft is stored for any extended time.

◆ WARNING : Failure to flush cooling system, when necessary, will severely damage engine and / or exhaust system. Never flush a hot engine. Make sure engine operates during entire procedure.

PROCEDURE

◆ WARNING : Perform this operation in a well ventilated area. Do not touch any electrical parts or jet pump area when engine is running.

Clean jet pump by spraying water in its inlet and outlet and then spray BOMBARDIER LUBE lubricant.

◆ WARNING : Always remove safety lanyard cap from switch to prevent accidental engine starting before cleaning the jet pump area. Engine must not be running for this operation.

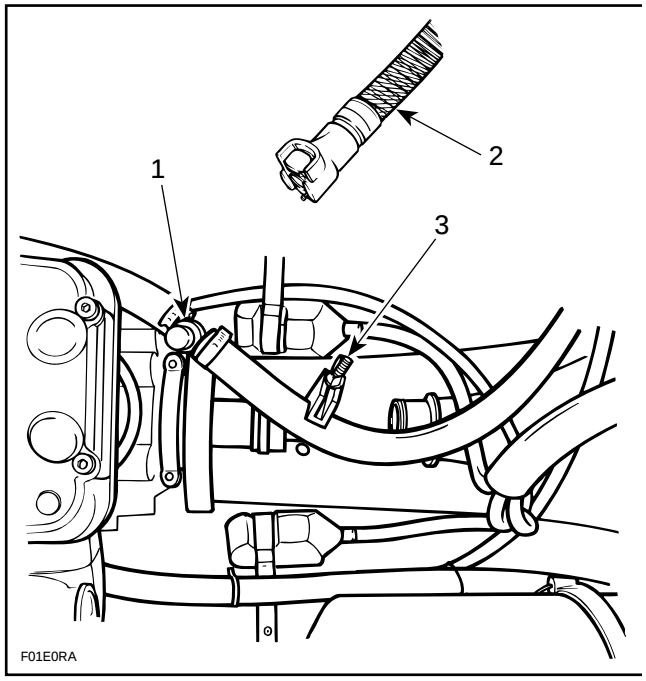
Remove seat to allow access of cooling system (except for the HX model).

All Models Except the HX

Remove dust cap from fitting spigot and attach coupler hose (P / N 295 500 258). Make sure coupler hose is properly locked to fitting spigot.

Install a hose pincher on water outlet hose.

○ NOTE : This prevents water from exiting through outlet socket. Remove hose pincher after flushing operation.



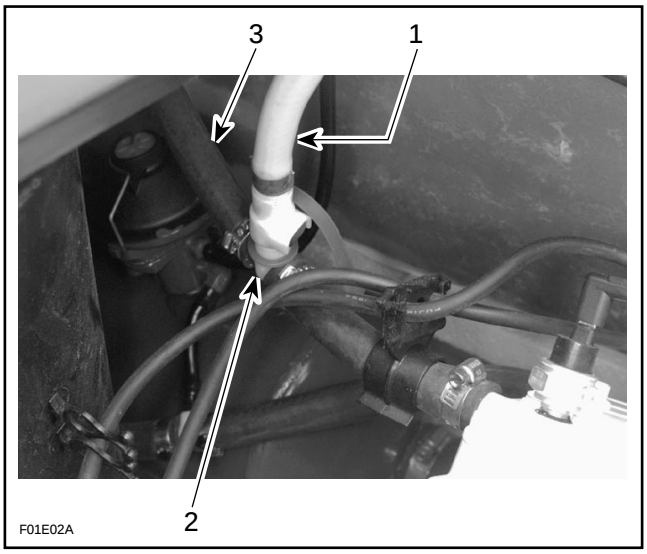
587 ENGINE

1. *Fitting spigot*
2. *Coupler hose*
3. *Hose pincher*

717 ENGINE

1. *Coupler hose*
2. *Fitting spigot*
3. *Hose pincher*

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787 ENGINE

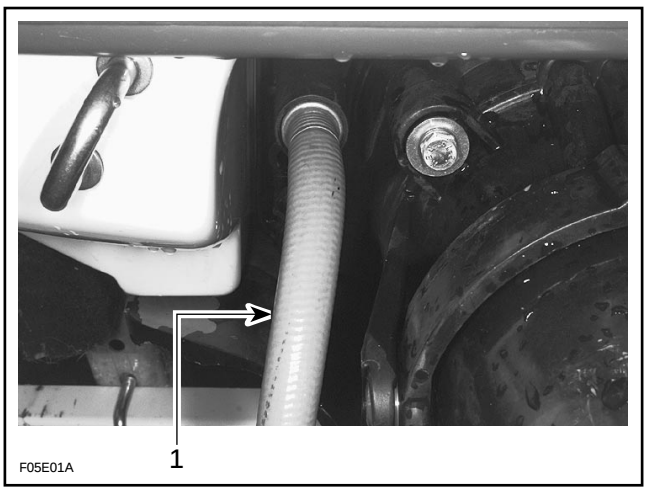
1. *Coupler hose*
2. *Fitting spigot*
3. *Install a hose pincher here*

Attach other end of coupler hose to a garden hose.

▼ CAUTION : Do not open water tap yet.

HX Model Only

Connect a garden hose directly to the adapter located at the rear of the watercraft.



1. *Garden hose*

○ NOTE : A quick connect hose adapter can be fixed to ease garden hose installation to watercraft adapter.

All Models

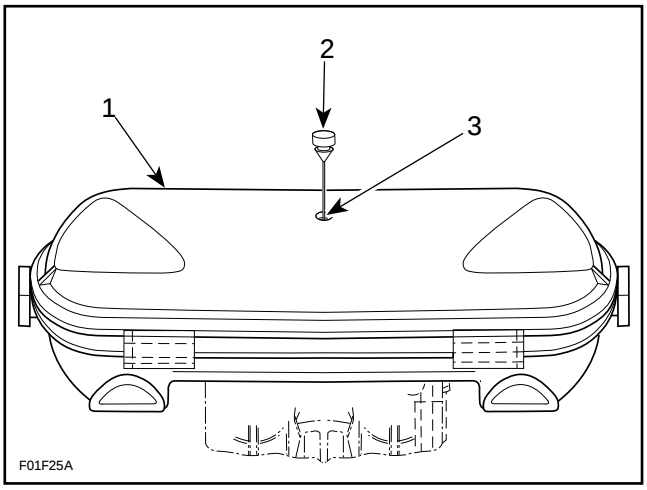
Start the engine then immediately open the water tap.

▼ CAUTION : Always start the engine before opening the water tap. Open water tap immediately after engine is started to prevent overheating.

Run the engine about 3 minutes at a fast idle around 3500 RPM.

Pull plug from air intake silencer cover.

Spray BOMBARDIER LUBE lubricant through air intake silencer cover keeping engine at fast idle.



1. *1Air intake silencer cover*
2. *Pull plug*
3. *Spray BOMBARDIER LUBE here*

○ NOTE : Lubrication of engine should be done ateast for one minute. After approximately half a minute, close fuel valve to run engine out of fuel while lubricating.

▼ CAUTION : When engine begins to run irregularly because of fuel starvation, immediately stop water flow before engine dies.

Close the water tap then stop the engine.

▼ CAUTION : Always close the water tap before stopping the engine.

Disconnect the garden hose.

All Models Except the HX

Unlock and remove coupler hose. Reinstall dust cap over fitting spigot.

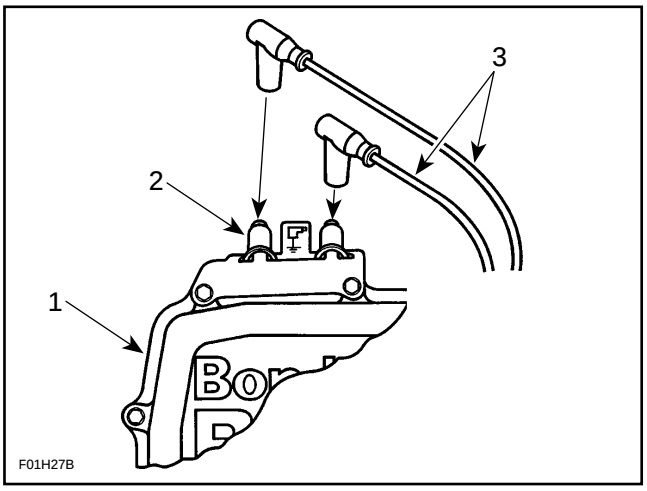
Remove hose pincher from water outlet hose.

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All Models

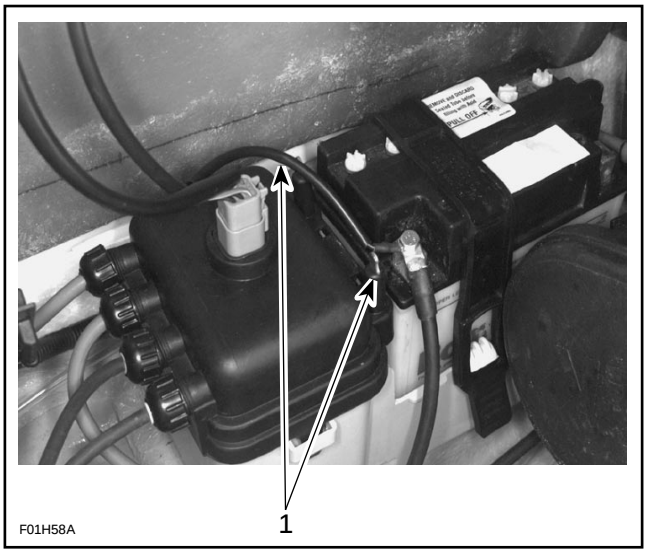
Wipe up any residual water from the engine.

Remove spark plug cables and connect them on the grounding device.



ALL MODELS EXCEPT THE XP

1. *.Magneto housing cover*
2. *Grounding device*
3. *Spark plug cables*



XP MODEL ONLY

1. *Grounding device*

Remove both spark plugs and spray BOMBARDIER LUBE lubricant into each cylinder.

Crank the engine a few turns to distribute the oil onto cylinder wall.

Apply anti-seize lubricant on spark plug threads then reinstall them.

Reinstall plug on air intake silencer cover.

NOTE : Engine fogging should be done with BOMBARDIER LUBE lubricant whenever the watercraft is to be stored for a few days or a long period.

CAUTION : Never leave rags or tools in the engine compartment or in the bilge.

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WATER-FLOODED ENGINE

General

If engine is water-flooded, it must be serviced within a few hours after the event. Otherwise engine will have to be overhauled.

▼ CAUTION : A water-flooded engine must be properly lubricated, operated then lubricated again, otherwise parts will be seriously damaged.

Procedure

Check fuel and oil reservoirs for water contamination. If necessary, siphon and refill with fresh fluids.

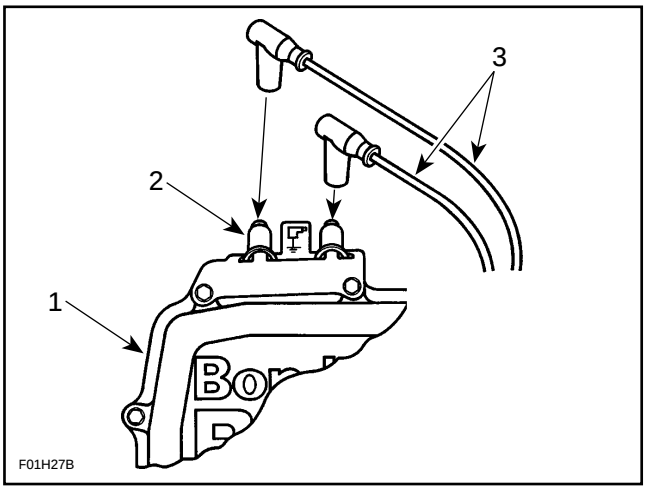
Turn fuel valve to OFF position then drain fuel filter bowl (refer to FUEL SYSTEM, 06-01).

Drain bilge if water is present.

Remove spark plug cables and connect them on the grounding device.

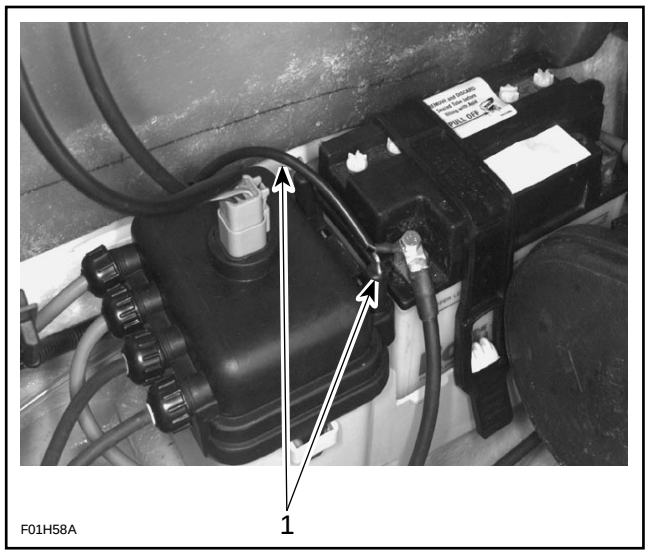
◆ WARNING : Never crank engine with spark plugs removed unless spark plug cables are connected to the grounding device.

All Models Except XP



1. Magneto housing
2. Grounding device
3. Spark plug cables

XP Model Only



1. Grounding device

All Models

Remove spark plugs and dry them with a clean cloth. A contact cleaner spray can be used. It may be preferable to replace spark plugs. Do NOT install spark plugs on engine.

Crank engine to drain crankcase.

▼ CAUTION : Be careful when cranking engine, water will spray out from spark plug holes.

Spray BOMBARDIER LUBE lubricant (P / N 293 600 016) into spark plug holes.

Crank engine again.

Reinstall spark plugs and spark plug cables then safety lanyard cap on switch.

Turn fuel valve to ON position.

Start engine ; It may be necessary to use the choke. If engine does not start, repeat previous steps as necessary.

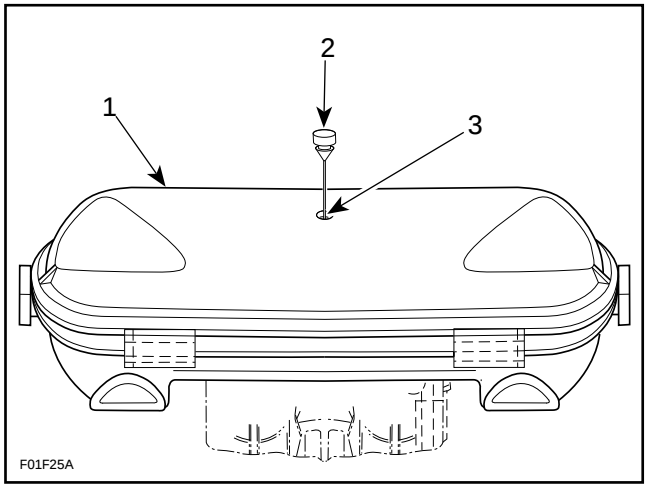
▼ CAUTION : To avoid starting motor overheating, the cranking period should not exceed 5-10 seconds and a rest period of 30 seconds should be observed between cranking cycles.

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NOTE : If engine does not start after several attempts, check ignition system for spark occurence. Refer to ELECTRICAL SYSTEM, 08-02.

Check crankshaft if needed, it can become misaligned or deflected. Refer to ENGINE, 04-03.

After engine has started, spray BOMBARDIER LUBE lubricant through air intake silencer while engine is running.



1. Air intake silencer cover
2. Pull plug
3. Spray BOMBARDIER LUBE here

Run engine until it reaches its normal operating temperature.

CAUTION : Water must be supplied to the engine to avoid overheating.

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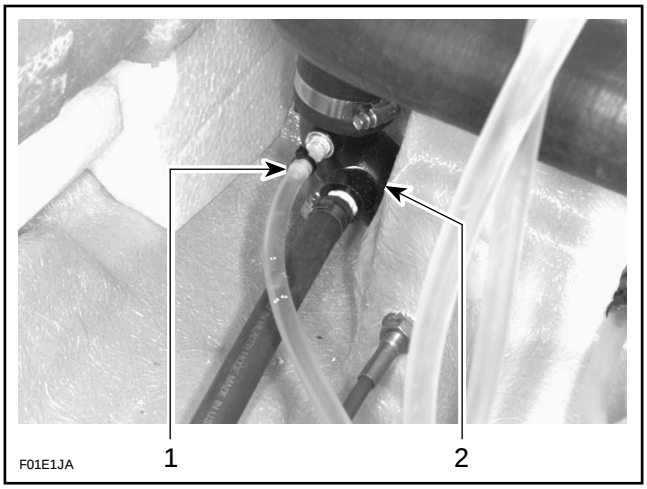
STORAGE

Engine Draining

Check engine drain hose. Make sure there is no sand or other particles in it and that it is not obstructed so that water can leave the engine. Clean hose and fitting as necessary.

CAUTION : Water in engine drain hose must be free to flow out, otherwise water could be trapped in engine. Should water freeze in engine, severe damage will occur. Check engine drain hose for obstructions.

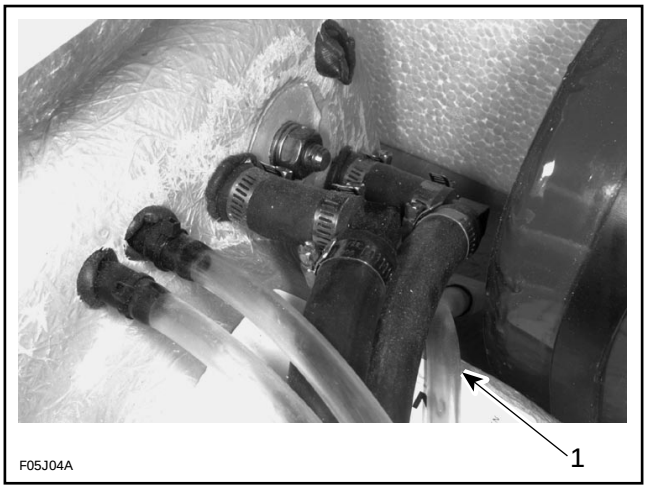
All Models Except HX



TYPICAL

1. *Engine drain hose*
2. *Exhaust outlet*

HX Model



1. *Engine drain hose*

Fuel System

Sea-Doo Fuel Stabilizer (P / N 413 408 600) can be added in fuel tank to prevent fuel deterioration and carburetor gumming. Follow manufacturer's instructions for proper use.

NOTE : Fuel stabilizer should be added prior engine lubrication to ensure carburetor protection against varnish deposit.

WARNING : Fuel is flammable and explosive under certain conditions. Always work in a well ventilated area. Do not smoke or allow open flames or sparks in the vicinity. Always wipe off any fuel spillage from the watercraft. Always turn the fuel valve to OFF position when storing the watercraft.

Cooling System Flushing and Engine Internal Lubrication

Cooling system has to be flushed with fresh water to prevent salt, sand or dirt accumulation which will clog water passages.

Engine must be lubricated to prevent corrosion on internal parts.

For proper procedure, refer to MAINTENANCE 02-03.

Propulsion System

Lubricant in impeller shaft reservoir should be drained. Reservoir should be cleaned and refilled with 90 mL (3.0 U.S. oz) of SEA-DOO synthetic 75W90 GL5 polyolester oil (P / N 293 600 011). Refer to PROPULSION SYSTEM 09-01.

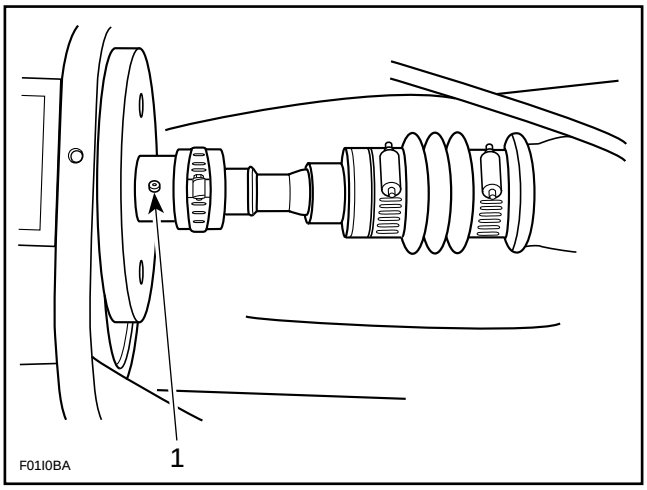
CAUTION : Use only SEA-DOO jet pump oil or equivalent synthetic gear oil, otherwise component service life could be reduced. Do not mix oil brands or types.

All Models Except HX

Lubricate PTO flywheel at grease fitting with synthetic grease (P / N 293 550 010).

CAUTION : Do not lubricate excessively. Immediately stop when a slight movement is noticed on rubber boot.

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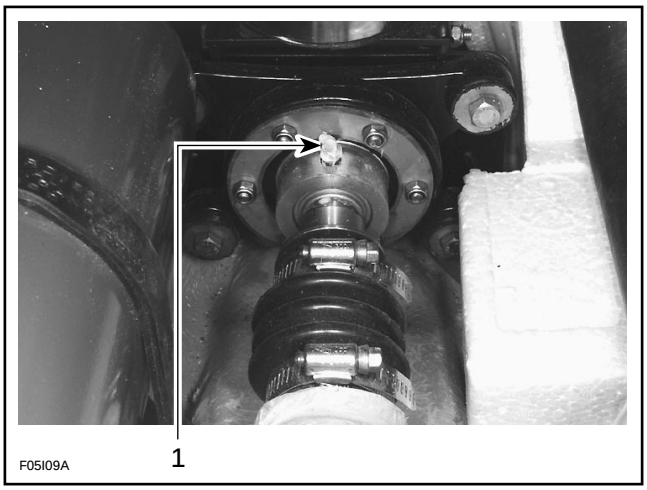


1. Grease PTO flywheel

▼CAUTION : Never leave any clothing, tool or other objects near PTO flywheel and seal carrier.

HX Model Only

Lubricate mid bearing of drive system at seal carrier grease fitting with synthetic grease.



1. Grease fitting

Battery

For battery removal, cleaning and storage, refer to ELECTRICAL 08-03.

Watercraft Cleaning

Clean the bilge with hot water and mild detergent or with bilge cleaner. Rinse thoroughly. Lift front end of watercraft to completely drain bilge. If any repairs are needed to body or to the hull, touch up paint and Gelcote® repair kit are available. Refer to SERVICE TOOLS AND PRODUCTS 01-02. Replace damaged labels / decals.

Wash the body with soap and water solution (only use mild detergent). Rinse thoroughly with fresh water. Remove marine organisms from the hull. Apply a nonabrasive wax.

▼CAUTION : Never clean apparent fiberglass and plastic parts with strong detergent, degreasing agent, paint thinner, acetone, etc.

If the watercraft is to be stored outside, cover it with an opaque tarpaulin to prevent sun rays and grime from affecting the plastic components, watercraft finish as well as preventing dust accumulation.

▼CAUTION : The watercraft must never be left in water for storage. Never leave the watercraft stored in direct sunlight.

Anticorrosion Treatment

Wipe off any residual water in the engine compartment.

Spray BOMBARDIER LUBE lubricant over all metallic components in engine compartment.

Lubricate the throttle cable with BOMBARDIER LUBE lubricant.

The seat should be partially left opened during storage (the hood for the HX). This will avoid engine compartment condensation and possible corrosion.

○ NOTE : If the watercraft is stored outside with seat (or the hood for the HX) partially opened and without a tarpaulin, unscrew the rear drain plug in order to avoid water build up in the bilge during rainfall. Tilt the watercraft to the rear so that water can flow out.

Additional Recommended Protection

In cool regions (where freezing point temperature may be encountered), cooling system should be filled with water and antifreeze solution.

▼CAUTION : Always use ethylene-glycol anti-freeze containing corrosion inhibitors specifically recommended for aluminum engines.

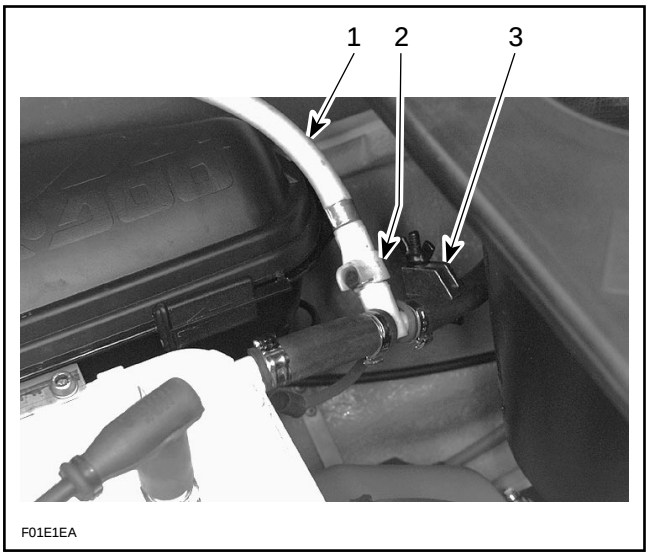
○ NOTE : The engine will not have to run during this operation.

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All Models Except the HX

Install coupler hose to fitting spigot.

Install a hose pincher to engine water return hose (beside fitting spigot).

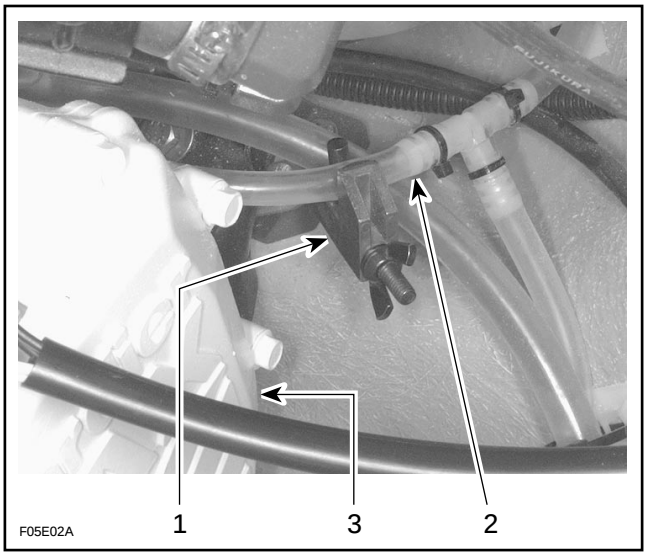


1. Coupler hose
2. Fitting spigot
3. Hose pincher

Pour slowly the antifreeze mixed with water in coupler hose until the colored solution appears in the engine drain hose.

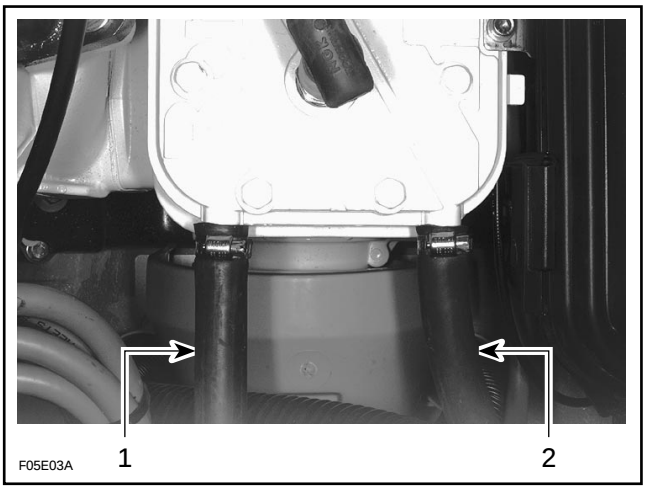
HX Model Only

Install a hose pincher to engine drain hose.



1. Hose pincher
2. Drain hose
3. Magneto housing cover

Disconnect engine water supply hose and engine water return hose.



1. Engine water supply hose
2. Engine water return hose

Install temporarily one hose to engine water inlet at cylinder head.

Insert a funnel into hose and pour about 1 liter (1 qt) of antifreeze mixed with water in engine.

Remove temporary hose and reconnect engine water supply hose and engine water return hose.

Remove hose pincher.

All Models

The following steps should be performed to provide the watercraft enhanced protection.

Remove muffler and drain out as much water as possible. Reinstall muffler.

OR : Disconnect one hose from muffler and pour some antifreeze solution inside muffler. Reconnect hose.

Lubricate the throttle cable with BOMBARDIER LUBE lubricant.

NOTE : A cable luber can be used on throttle cable end to inject BOMBARDIER LUBE lubricant.

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TROUBLESHOOTING

The following is provided to help in diagnosing the probable source of troubles. It is a guideline and should not be assumed to have all causes for all problems.

ENGINE WILL NOT START

OTHER OBSERVATION	POSSIBLE CAUSE	REMEDY
Engine does not turn over	• Safety lanyard cap worn or removed • Burnt 5 A fuse • 5 A fuse keeps on burning • Discharged battery • Battery connections • Water / fuel hydrolock) • Starter • Seized engine • Seized jet pump	• Replace / reinstall • Check wiring then replace fuse • Check wiring, solenoid and MPEM • Check / recharge • Check / clean / tighten • Check, refer to section 02-03 • Check, refer to section 08-04 • Check / repair as needed • Check, refer to section 09-01
Engine turns slowly	• Discharged / weak battery • Restriction in jet pump • Seizure in jet pump • Partial engine hydrolock • Partial engine seizure • Worn starter	• Check / charge / replace • Check / clean pump • Inspect, refer to section 09-01 • Check, refer to section 02-03 • Check compression, refer to section 04-02 • Check, refer to section 08-04
Engine turns over	• Fuel water-contaminated • Dirty fuel filter • Fouled spark plugs • Water in engine • Carburetion • Ignition • Flooded engine – Needle valve stuck open • Excessive rotary valve clearance • Internal engine damage • Sheared flywheel key • Incorrect rotary valve timing	• Renew supply • Clean / replace • Replace • Check, refer to section 02-03 • Check, refer to section 06-03 • Check, refer to section 08-02 • Check, refer to section 06-03 • Check, refer to section 04-04 • Check, refer to section 04-02 and 04-03 • Check timing mark, refer to section 08-02 • Check, refer to section 04-04
No spark at spark plugs	• Faulty rev limiter	• Replace M.P.E.M. (587 and 717 engines) or DC-CDI ignition module (787 engine)

NOTE : Watercraft equipped with the Digitally Encoded Security System, refer to ELECTRICAL SYSTEM 08-06 for troubleshooting of problems related with this system.

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ENGINE MISFIRES, RUNS IRREGULARLY

OTHER OBSERVATION	POSSIBLE CAUSE	REMEDY
Weak spark	• Fouled, defective, worn spark plugs • Faulty rev limiter or ignition • Sheared flywheel key	• Check / verify heat range / gap / replace • Check, refer to section 08-02 • Check timing mark, refer to section 08-02
Lean fuel mixture Dry spark plug (except when water fouled)	• Low fuel level • Stale or water fouled fuel • Fuel filter dirty or restricted • Carburetion dirty or out of adjustment • Leaking crankshaft seal(s), intake or rotary valve cover • Restricted fuel valve • Loose carburetor	• Check / refill • Check / siphon and refill • Check / clean / replace • Check / clean / adjust, refer to section 06-03 • Check / test / replace, refer to engine section 04-03 and 04-04 • Check / replace • Tighten carburetor(s)
Rich fuel mixture Fouled spark plug	• Partially closed choke • Flame arrester dirty or restricted • Carburetor adjustment or setting • Loose main jet • Rotary valve shaft seal leaking • Oil pump adjustment • Worn needle(s) and seal(s) • Excessive rotary valve clearance	• Check / adjust choke cable • Check / clean / replace • Check / clean / adjust, refer to section 06-03 • Check, refer to section 06-03 • Check / replace, refer to section 04-04 • Check / adjust, refer to section 07-02 • Check, refer to section 06-03 • Check, refer to section 04-04
Difficult to start	• Incorrect rotary valve timing • Excessive rotary valve clearance	• Check / adjust, refer to section 04-04 • Check, refer to section 04-04

ENGINE OVERHEATS

OTHER OBSERVATION	POSSIBLE CAUSE	REMEDY
Monitoring beeper sounds continuously	• Restricted jet pump water intake • Cooling system restriction • Grounded temperature sensor or sensor wire	• Check / clean • Check / flush, refer to section 02-02 • Check / repair / replace

ENGINE CONTINUALLY BACKFIRES

OTHER OBSERVATION	POSSIBLE CAUSE	REMEDY
Weak spark	• Fouled, defective spark plugs • Malfunction of rev limiter	• Clean / replace • Clean / replace, refer to section 08-02
Ignition timing	• Incorrect setting • Sheared flywheel key	• Check / reset, refer to section 08-02 • Check / replace, refer to section 08-02
Rotary valve	• Incorrect timing	• Check / reset, refer to section 04-04
Carburetor	• Carburetion to lean	• Check / adjust, refer to section 06-03
Engine	• Intake leak / crankshaft seal failure	• Pressure check engine to 48 kPa (7 PSI)

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ENGINE DETONATION OR PINGING

OTHER OBSERVATION	POSSIBLE CAUSE	REMEDY
Ignition	• Timing too far advanced • Spark plug heat range too high	• Check / reset • Check / change to correct range
Engine temperature	• Engine overheats • Fuel of poor quality	• Check, refer to engine overheats • Use good quality fuel

ENGINE LACKS ACCELERATION OR POWER

OTHER OBSERVATION	POSSIBLE CAUSE	REMEDY
Engine revs lower than its maximum operational RPM (787 engine) Peak performance is delayed until higher RPM range is reached (787 engine)	• Weak spark • Carburetion, jetting too rich / lean • Throttle does not open fully • Low compression • Exhaust system restriction • Water in fuel or oil • Debris in needle valve • Impeller leading edge damaged • Twisted crankshaft • RAVE valve does not open • • • RAVE valve is stuck opened •	• Check / replace, refer to section 08-02 • Check / adjust, refer to section 06-03 • Check / readjust, refer to section 06-03 • Check / repair, refer to section 04-02 • Check / clean • Check / siphon / replace • Check / clean, refer to section 06-03 • Check / replace, refer to section 09-01 • Check, refer to section 04-03 • Check, refer to section 04-02 • • • Check, refer to section 04-02 •

ENGINE RUNS TOO FAST

OTHER OBSERVATION	POSSIBLE CAUSE	REMEDY
Engine RPM too high	• Faulty rev limiter • Improper impeller pitch (too low)	• Check, refer to section 08-02 • Check / replace, refer to section 09-01
Jet pump cavitation	• Damaged leading or trailing edge of impeller	• Check / replace NOTE : Leading edge damage contributes to poor performance from start. Trailing edge damage contributes to poor top performance and stator vanes erosion.
Jet pump ventilation	• Air leak of pump housing or ride shoe	• Check / reseal, refer to section 09-01

ABNORMAL NOISE FROM PROPULSION SYSTEM

OTHER OBSERVATION	POSSIBLE CAUSE	REMEDY
	• Weeds / debris caught in intake grate or impeller • Low oil level in pump housing • Damaged or bent drive shaft • Broken motor mounts	• Check / clean • Check / troubleshoot source of leak / refill supply, refer to section 09-01 • Check / replace, refer to section 09-02 • Check / replace, refer to section 04-01

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REMOVAL AND INSTALLATION

GENERAL

It is not necessary to remove engine from watercraft for TOP END nor PTO FLYWHEEL AND MAGNETO servicing. However engine removal is necessary to repair BOTTOM END.

HX Model Only

Engine can be removed with jet pump in place. It is not necessary to perform engine alignment when engine support is not loosen from rubber mounts. Engine rubber mounts sit on adapters which can be loosen prior lifting engine. If an engine rubber mount must be replaced, jet pump, driveshafts and seal carrier have to be removed and engine alignment performed.

REMOVAL FROM WATERCRAFT

All Models Except HX

In order to remove engine from watercraft proceed as follows.

▼ CAUTION : Whenever removing engine from watercraft, engine / jet pump alignment must be performed.

Jet Pump Removal

To withdraw jet pump unit ass'y, refer to PROPULSION SYSTEM 09-01.

All Models

Electrical Connections

First, remove BLACK negative cable from battery, then RED positive cable.

◆ WARNING : Always disconnect starter or battery cables exactly in the specified order, BLACK negative cable first. It is recommended to disconnect electrical connections prior to disconnecting fuel lines.

All Models Except HX and XP

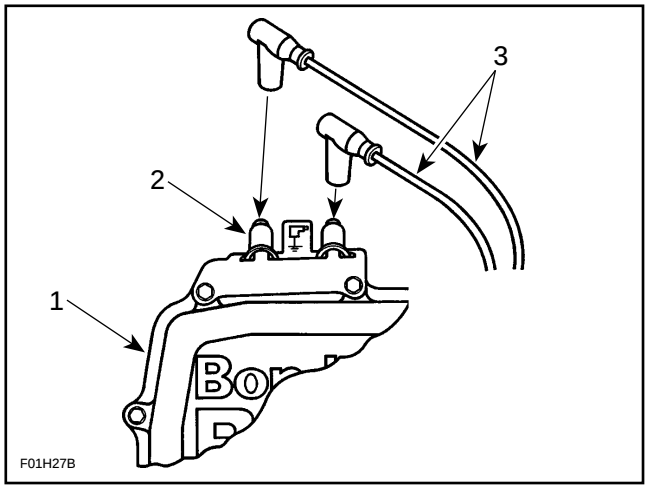
Remove battery holding straps and disconnect vent tube from battery.

Remove battery.

All Models

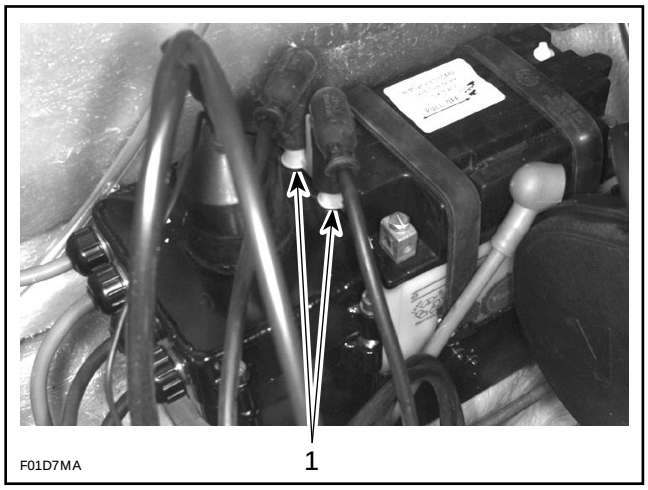
Disconnect thermosensor wire and spark plug cables.

Connect spark plug cables onto grounding device.



ALL MODELS EXCEPT XP

1. *Magneto housing cover*
2. *Grounding device*
3. *Spark plug cables*

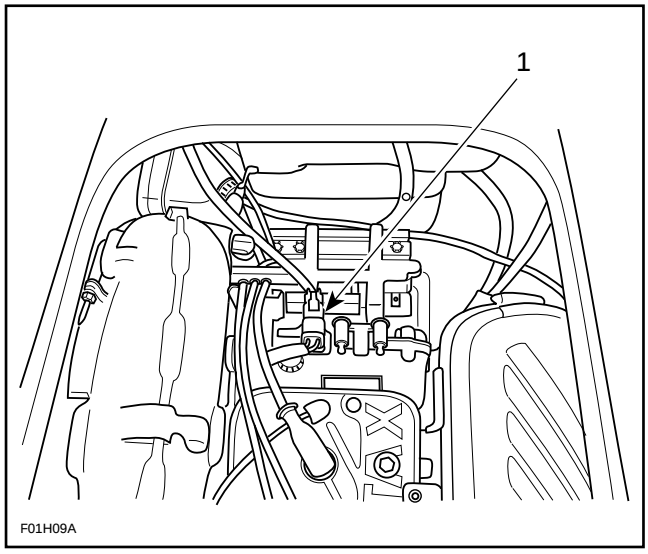


XP MODEL

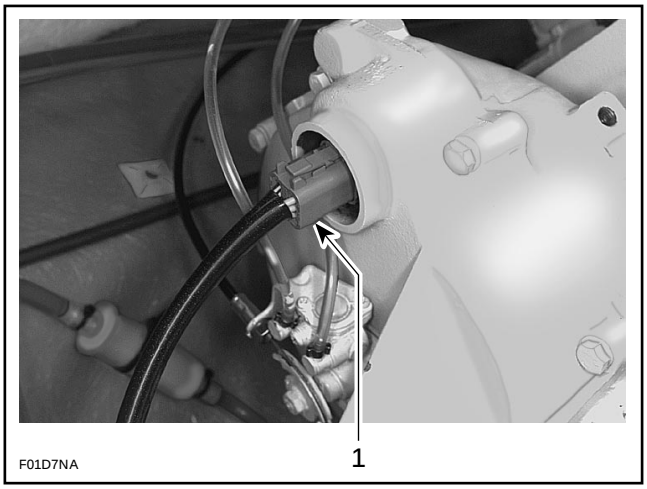
1. *Grounding device*

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Disconnect magneto wiring harness.



ALL MODELS EXCEPT XP
1. Unplug connector



XP MODEL
1. Unplug connector

Tuned Pipe

To remove tuned pipe, refer to ENGINE 04-05.

Air Intake Silencer

To remove air intake silencer, refer to FUEL SYSTEM 06-02.

Carburetor(s)

All Models Except the HX

To remove carburetor(s), refer to FUEL SYSTEM 06-03.

HX Model Only

Disconnect choke and throttle cables from carburetors.

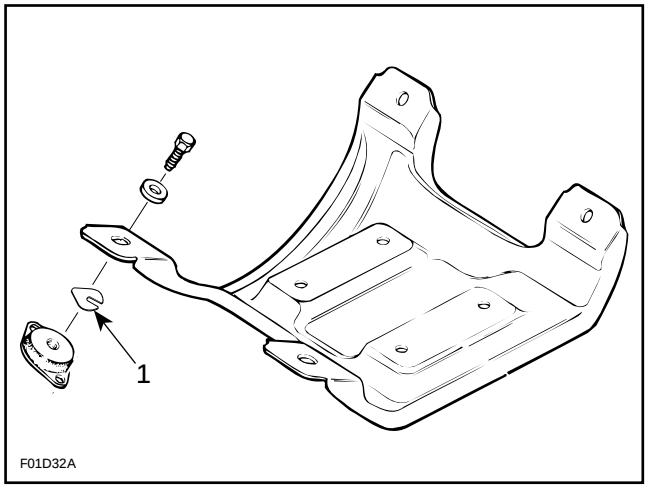
Disconnect fuel supply and fuel return hoses.

Engine Support Mounts

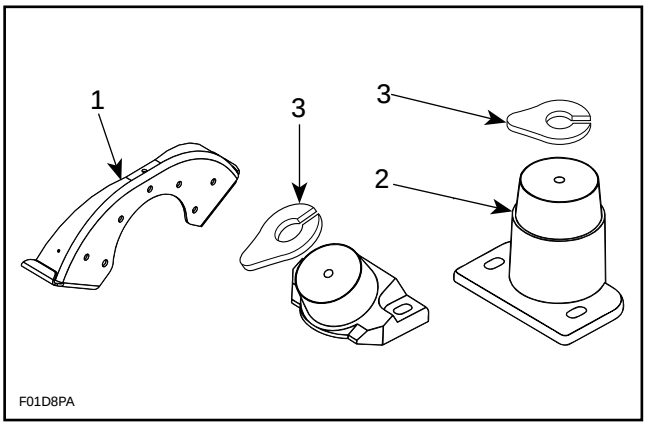
All Models Except the HX

Remove engine support mount screws.

NOTE : Be careful when removing engine support mount screws, shims could have been installed between engine support and rubber mounts. To ease engine / jet pump alignment, indicate shim location for reinstallation.



TYPICAL - ALL MODELS EXCEPT XP
1. Shim



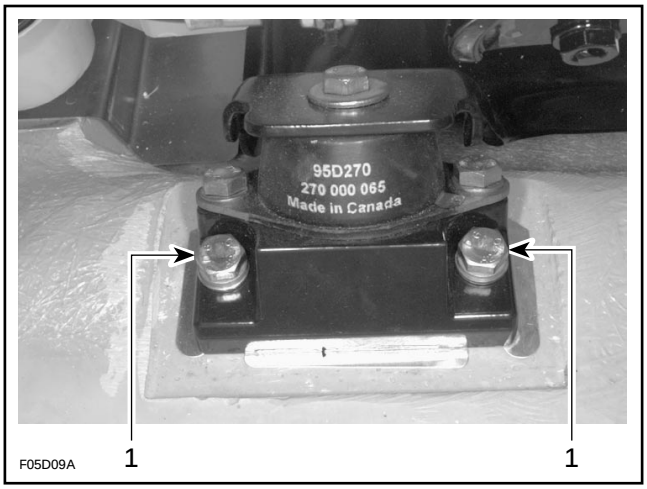
XP MODEL
1. Rear support
2. Front support
3. Shim

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HX Model

Loosen screws of engine rubber mount adapters.

NOTE : Rubber mount adapters sit on shims which control engine / jet pump alignment. Always note position of shims for reinstallation, to avoid altering engine alignment.



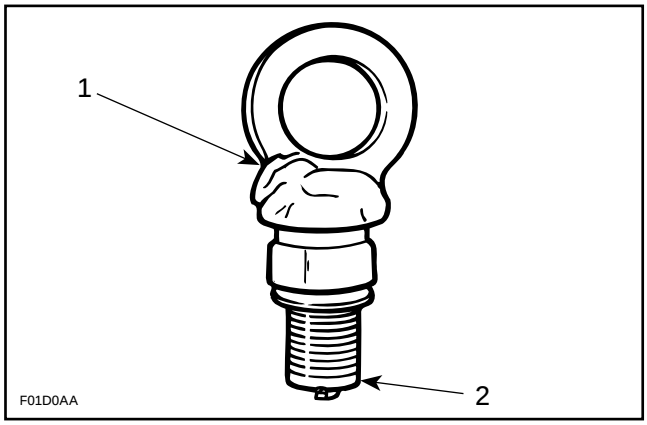
1. Adapter screw

Lifting Engine

All Models Except the XP

Engine can be easily lifted using the following suggested tools.

– Cut porcelain from 2 old spark plugs.
– Weld a lock washer approximately 20 mm diameter on each spark plug as shown.



1. Weld a lock washer
2. Old spark plug

Remove spark plugs and replace by special tools.

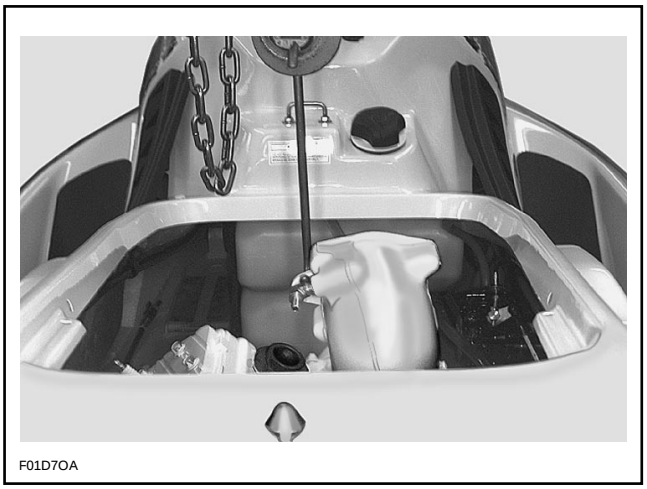
Hook a sling into holes of special tools.

Using a chain block, a hoist or other suitable equipment, slightly lift engine to ease the remaining component removal.

CAUTION : Take care not to damage cable or oil injection hoses.

XP Model

Engine can be easily lifted by inserting a hook into exhaust manifold eyelet.



Using a chain block, a hoist or other suitable equipment, slightly lift engine to ease the remaining component removal.

CAUTION : Take care not to damage cable or oil injection hoses.

Remove rear engine support.

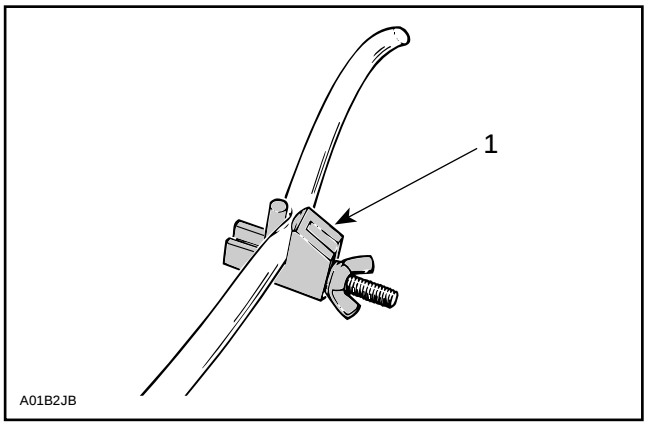


1. Rear support

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All Models

Install a hose pincher to oil supply hoses of oil injection pump and rotary valve shaft ; then, disconnect hoses.

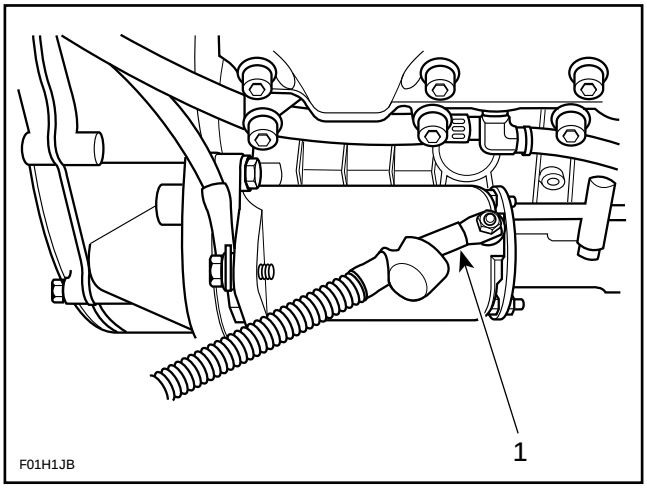


TYPICAL

1. Hose pincher (P / N 295 000 076)

Install a hose pincher to oil return hose of rotary valve shaft ; then, disconnect hoses.

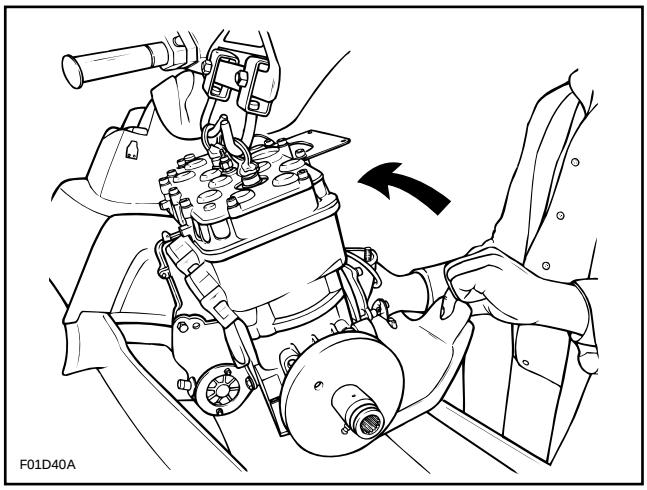
Disconnect RED positive cable from starter post.



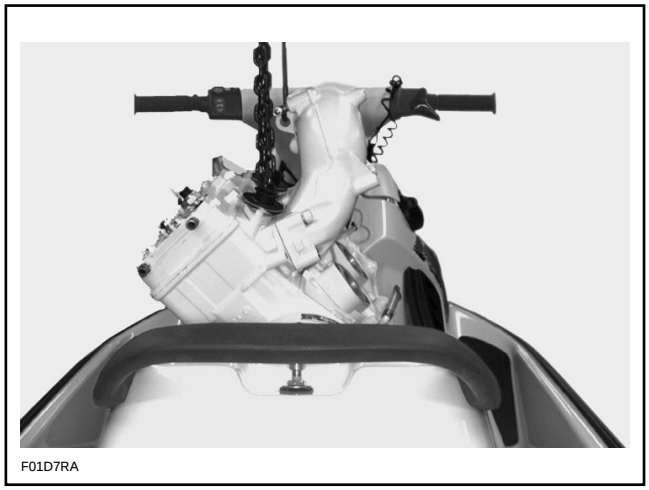
1. Disconnect RED positive cable

Carry on engine lifting until engine support reaches body opening (except the XP) then tilt engine so that it can be removed from the watercraft.

▼CAUTION : Be careful not to scratch body with engine support or to hit any component.



TYPICAL - ALL MODELS EXCEPT THE XP



XP MODEL

CLEANING

Wipe off any spillage in bilge. Clean with a bilge cleaner.

Clean external parts of engine.

INSTALLATION

Installation of engine in watercraft is essentially the reverse of removal procedures. However pay particular attention to the following.

Rubber Mount, Shim and Screw

Check tightness and condition of rubber mounts. If they have been removed, apply Loctite 242 (blue) on screw threads. Torque screws to 25 N•m (18 lbf•ft).

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▼ CAUTION : Strict adherence to this torque is important to avoid damaging threads of aluminum insert in bilge.

NOTE : Always remove rubber mounts one at a time and reinstall each shim to its original location.

Engine Support and Nut

All Models Except the XP

Properly install support on crankcase so that rounded portion of support matches with MAG side of crankcase. Apply Loctite 242 (blue) on threads then torque nuts in a criss-cross sequence to 35 N•m (26 lbf•ft).

Oil Injection Hoses

Make sure to reinstall hoses before completely lowering engine in bilge.

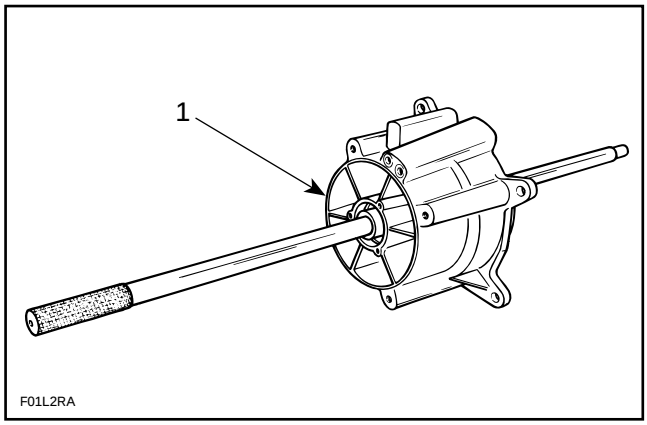
Positive Starter Cable

Torque nut of positive starter cable to 6 N•m (53 lbf•in). Apply dielectric grease on nut.

Engine / Jet Pump Alignment

Alignment is necessary to eliminate possible vibration and / or damage to components. Check alignment of engine using alignment tool.

NOTE : On the HX model, it is not necessary to perform engine alignment when the engine support is not loosen from rubber mounts.

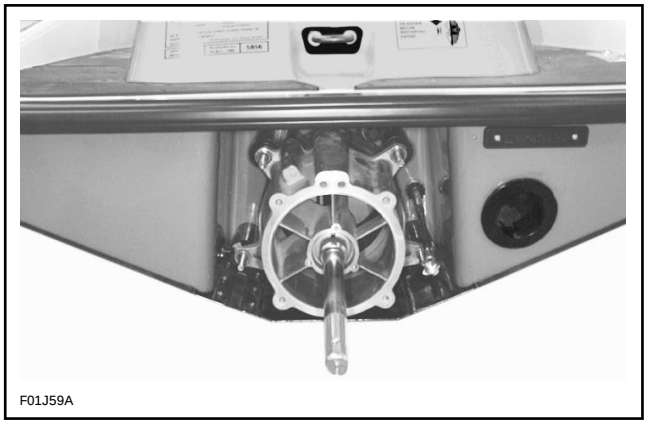


1. *Housing (P / N 295 000 090)*
2. *Alignment shaft (P / N 295 000 093) or (P / N 295 000 141) for the HX*

To verify alignment proceed as follows :

– Install housing on hull with 4 nuts.

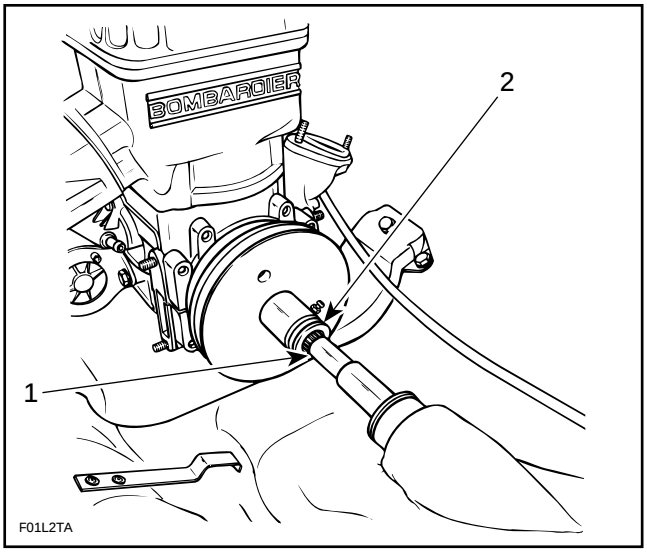
– Carefully slide shaft through housing.



TYPICAL

– Insert shaft end into PTO flywheel.

NOTE : If the alignment is correct, the shaft will slide easily without any deflection in PTO flywheel splines.



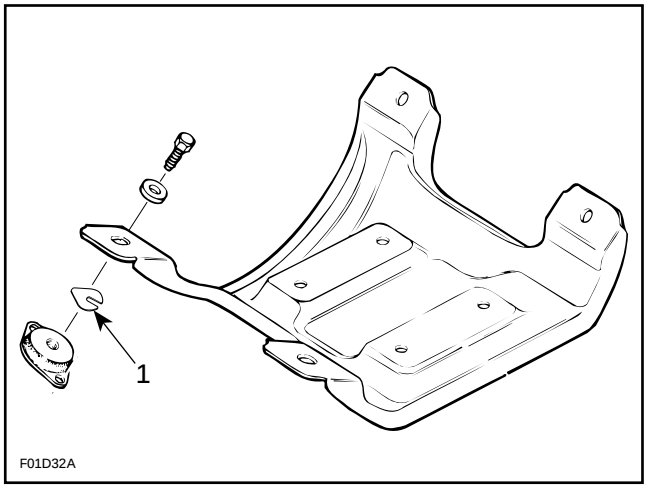
TYPICAL

1. *Shaft end*
2. *PTO flywheel*

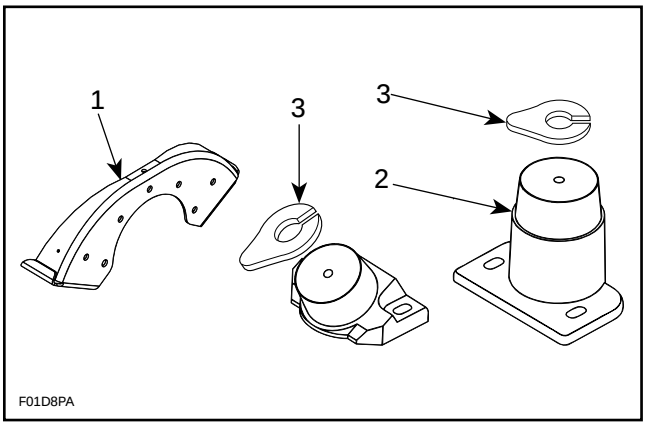
If the alignment is incorrect loosen engine support screws to enable to align PTO flywheel with shaft end.

NOTE : Use shim(s) (P / N 270 000 024) or (P / N 270 000 025) as necessary between engine support and rubber mounts to correct alignment.

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TYPICAL - ALL MODELS EXCEPT THE XP
1. Shim



XP MODEL
1. Rear support
2. Front support
3. Shim

▼ CAUTION : Whenever shims are used to correct alignment, never install more than 6 mm (0.240 in) shim thickness. If alignment cannot be obtained verify for engine support bending.

Engine Support Screws

Apply Loctite 242 (blue) on screw threads.

Retorque engine support screws to 25 N•m (18 lbf•ft) when procedure is completed.

○ NOTE : Whenever alignment tool is not utilized, apply BOMBARDIER LUBE lubricant on its shaft and inside the housing to eliminate possible corrosion.

Final Inspection

Check throttle cable condition and lubricate cable with BOMBARDIER LUBE lubricant. After its installation, properly adjust and bleed oil injection pump as specified in LUBRICATION SYSTEM 07-02.

Pressure test fuel system, refer to FUEL SYSTEM 06-01.

Verify all connections and hoses condition.

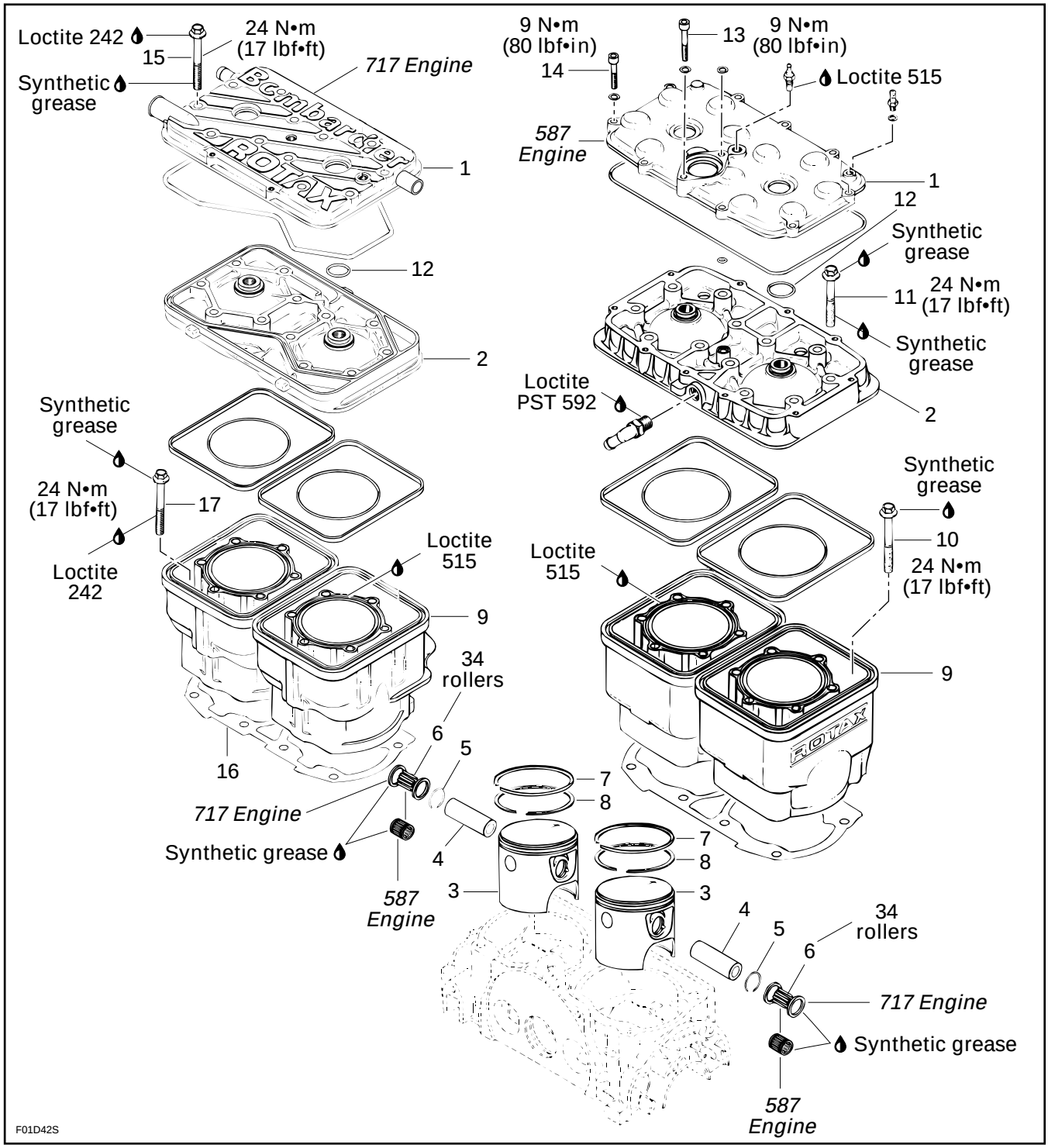
Run engine and ensure there is no leakage.

▼ CAUTION : Water must be supplied to cool the engine.

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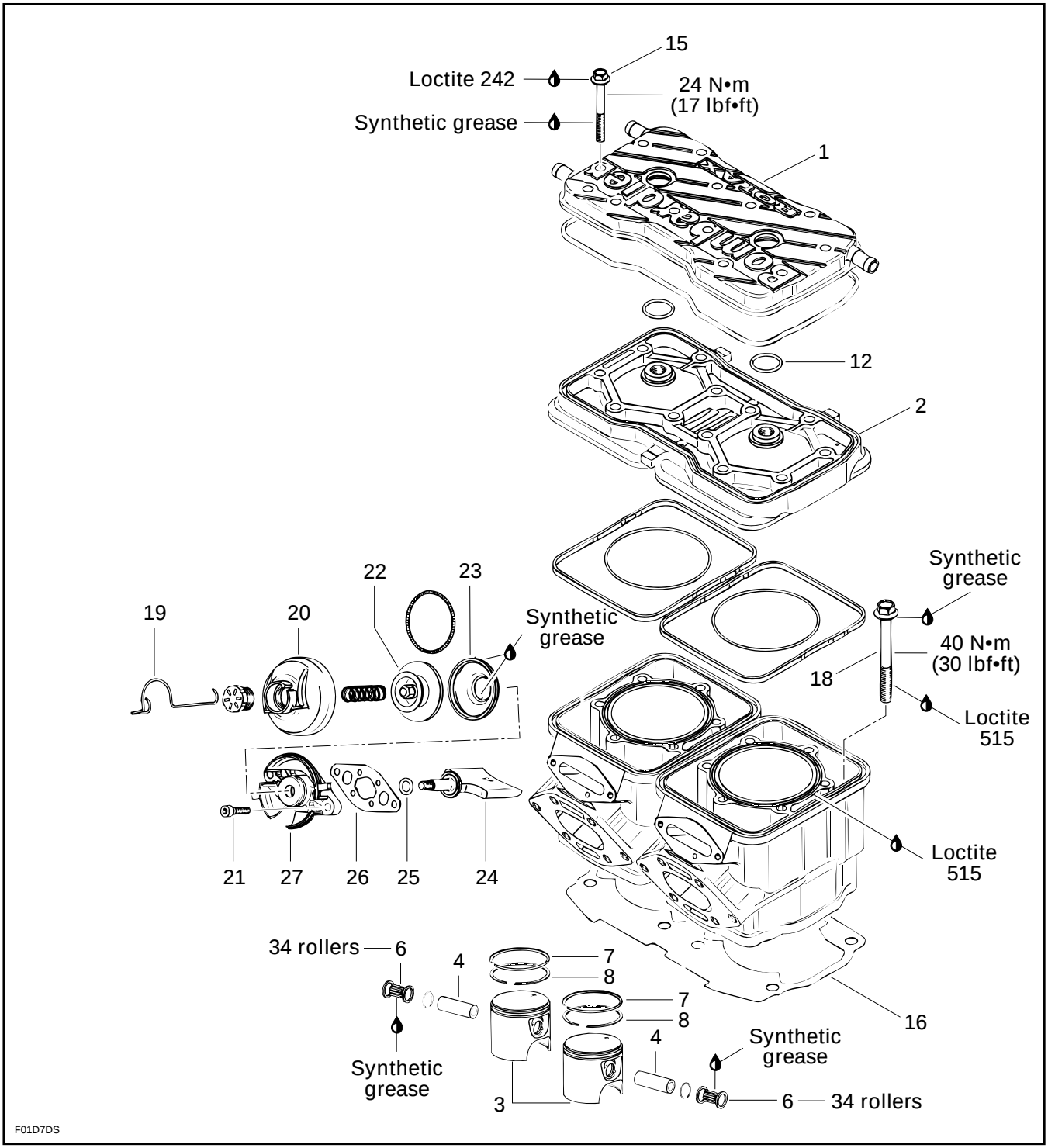
TOP END

587 and 717 Engines



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787 Engine



PARTS
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ENGINE DESCRIPTION

587, 717 and 787 Engines

The 2-stroke ROTAX engine rotates counterclockwise seen from the rear (PTO flywheel). It has a rotary valve to control opening and closing of intake. Lubrication is provided by a variable rate oil injection pump. It is cooled by water supplied from the jet pump. It has a NIPPONDENSO Capacitor Discharge Ignition System. The fuel is provided by diaphragm MIKUNI carburetor(s) having an integrated fuel pump.

▼ CAUTION : No engine components can be interchanged between engines.

787 Engine Only

This engine is canted at a 30 degree angle, lowering the center of gravity of the watercraft. Cylinder exhaust ports are located on the same side of the intake, allowing a new high volume tuned pipe design. This engine also features the RAVE system (Rotax Adjustable Variable Exhaust). The RAVE system working in combination with the high volume tuned pipe offers a broader power band.

GENERAL

When repairing a seized engine, connecting rods should be checked for straightness and crankshaft for deflection / misalignment. Refer to ENGINE 04-03 for procedures.

DISASSEMBLY

In order to repair engine top end proceed as follows :

Electrical Connections

Disconnect thermosensor wire and spark plug cables.

Connect spark plug cables on grounding device.

Exhaust System

To withdraw tuned pipe, refer to ENGINE 04-05.

Air Intake Silencer

To remove air intake silencer, refer to FUEL SYSTEM 06-02.

1,2, Cylinder Head Cover and Cylinder Head

Remove cylinder head cover.

○ NOTE : With the 717 and 787 engines, cylinder head screws secure also cylinder head cover.

If shells, sand, salt or any other particles are present in cylinder head, clean with a vacuum cleaner.

Remove cylinder head.

If shells, sand, salt water or any other particles are present in cylinder cooling jacket, clean with a vacuum cleaner.

Remove cylinders, being careful that connecting rods do not hit crankcase edge.

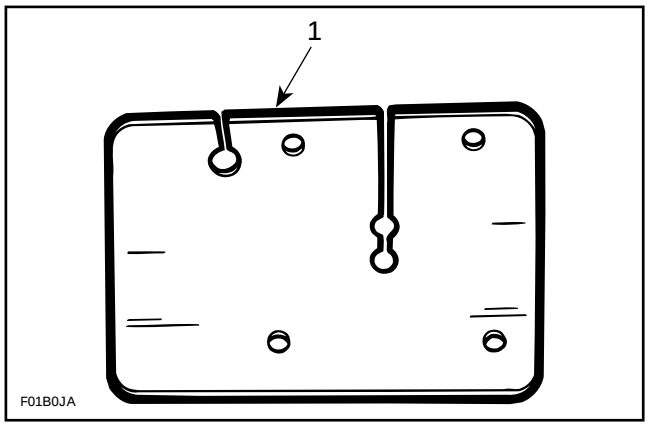
◆ WARNING : If screws need to be heated for removal when engine is in watercraft, fuel system pressurization must be done first. Do not use open flame ; use a heat gun.

○ NOTE : Even if only one cylinder needs repair, both cylinders should be lifted to allow 1-piece cylinder base gasket replacement.

3,4,5,6, Piston, Piston Pin, Circlip and Roller Bearing

○ NOTE : The 717 and 787 engines feature cageless piston pin bearing.

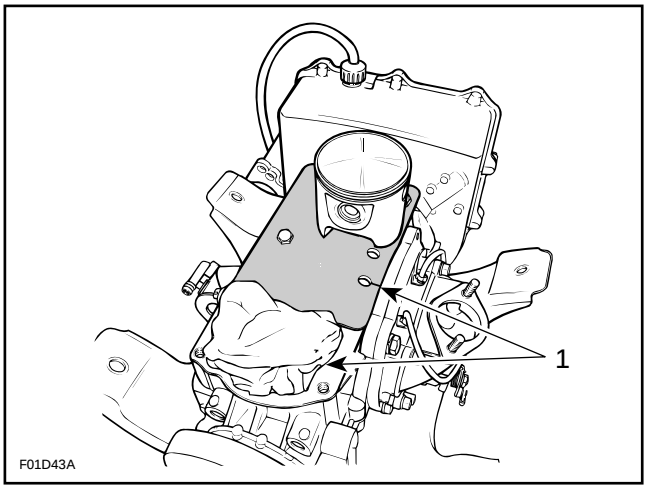
Bring piston to Top Dead Center and install rubber pad (P / N 295 000 101) over crankcase opening. Secure with screws. Lower piston until it sits on pad.



1. Rubber pad

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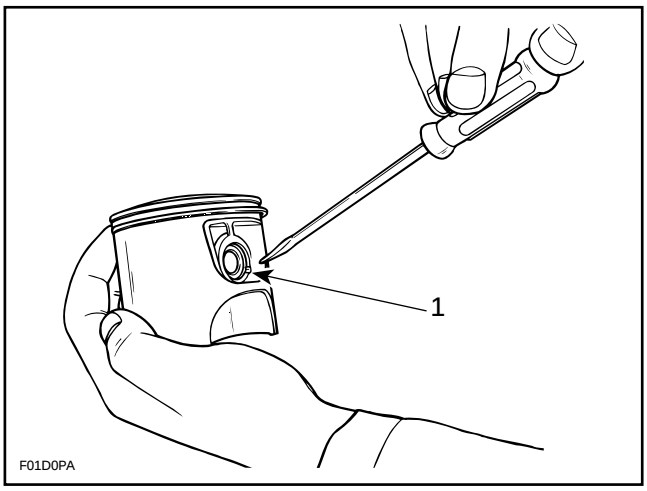
If the other cylinder has been removed, completely cover its opening with a clean rag.



1. Openings covered with rag and rubber pad

To remove circlip, insert a pointed tool in piston notch then pry it out and discard.

◆ WARNING : Always wear safety glasses when removing piston circlips.

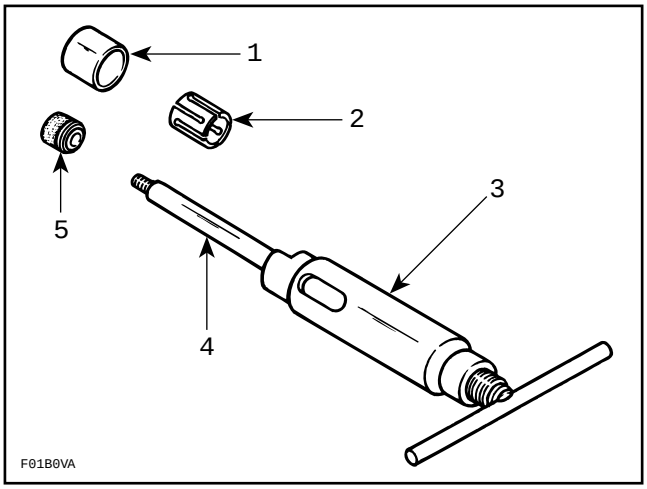


TYPICAL
1. Piston notch

717 and 787 Engines

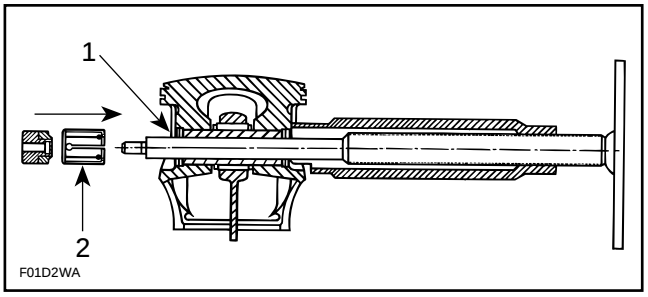
To extract piston pin, use piston pin puller (P / N 290 877 092) as follows :

– Fully thread on puller handle.
– Insert extractor spindle into the piston pin.
– Slide the expansion sleeve (P / N 290 877 041) onto the spindle.
– Screw in extracting nut (P / N 290 877 155) with the movable extracting ring towards spindle.



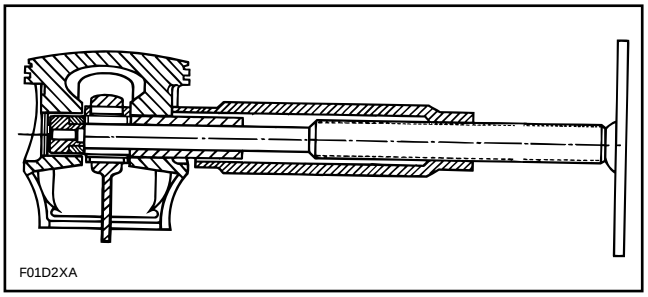
PISTON PIN PULLER (P / N 290 877 092)
1. Bushing (P / N 290 877 181)
2. Expansion sleeve (P / N 290 877 041)
3. Extractor sleeve
4. Extractor spindle
5. Extracting nut (P / N 290 877 155)

– Firmly hold puller and rotate handle to pull piston pin.



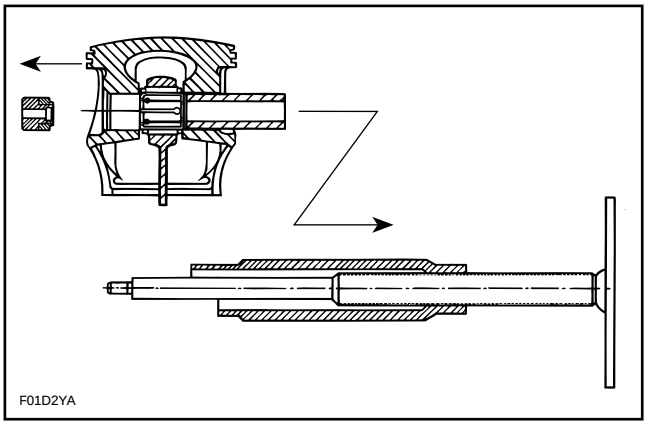
1. Circlip at this side not to be removed
2. Grease expansion sleeve

– By turning the spindle, pull out piston pin until it is completely removed from bearing.



– Rotate spindle until extracting nut can be removed.
– Remove spindle and extractor sleeve from piston pin.
– Carefully remove the piston.

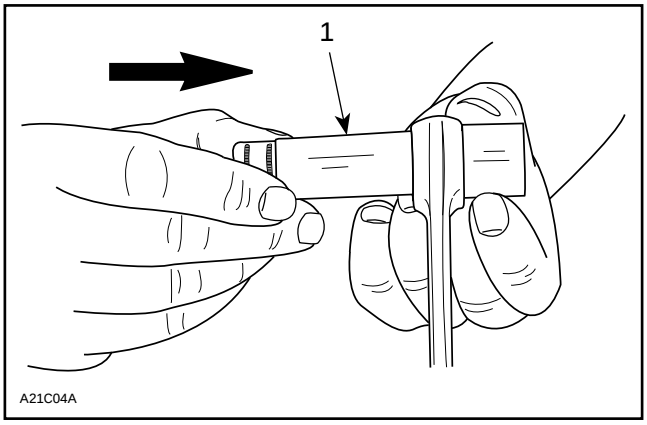
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– The needles, thrust washers and the expansion sleeve remain in the connecting rod bore and may be used again.

To remove rollers with the thrust washers from the connecting rod bore, push them together with the expansion sleeve into the bushing (P / N 290 877 181) using any suitable 23 mm (.905 in) diameter pusher.

▼ CAUTION : Recover rollers, make sure that 34 rollers are found for each piston.



1. Pusher 23 mm (.905 in)

587 Engine

To extract piston pin, it is possible to use piston pin puller (P / N 295 000 105) as follows :

– Fully thread on puller handle.
– Insert extractor spindle into the piston pin.
– Screw extracting nut (P / N 290 877 115) with the movable extracting ring towards spindle.
– Hold puller firmly and rotate puller handle to pull piston pin.

CLEANING

Discard all gaskets and O-rings.

Clean all metal components in a solvent.

Clean water passages and make sure they are not clogged.

Remove carbon deposits from cylinder exhaust port, cylinder head and piston dome.

Clean piston ring grooves with a groove cleaner tool, or a piece of broken ring.

INSPECTION

Visually inspect all parts for corrosion damage.

Inspect piston for damage. Light scratches can be sanded with a fine sand paper.

Inspect plane surfaces for warpage. Small deformation can be corrected by grinding surface with a fine sand paper. Install sand paper on a surface plate and rub part against oiled sand paper.

The inspection of engine top end should include the following measurements.

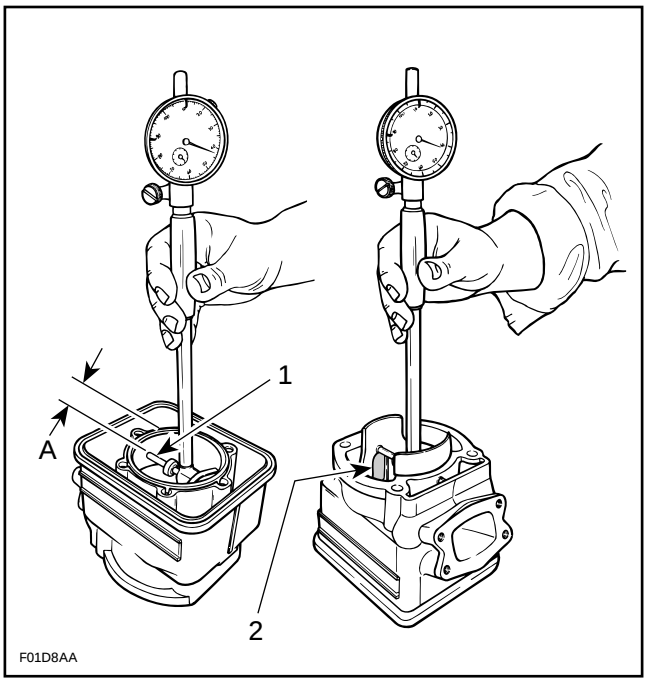
ENGINE MEASUREMENT	TOLERANCES		
	NEW PARTS (min.)	(max.)	WEAR LIMIT
Cylinder Taper	N.A.	0.05 mm (.002 in)	0.1 mm (.004 in)
Cylinder Out of Round	N.A.	0.008 mm (.0003 in)	0.08 mm (.003 in)
Piston / Cylinder Wall Clearance for the 587 Engine	0.05 mm (.002 in)	0.07 mm (.0028 in)	0.20 mm (.008 in)
Piston / Cylinder Wall Clearance for the 717 Engine	0.06 mm (.0024 in)	0.08 mm (.0031 in.)	0.20 mm (.008 in)
Piston / Cylinder Wall Clearance for the 787 Engine	0.10 mm (.004 in)	0.12 mm (.005 in)	0.15 mm (.006 in)
Ring / Piston Groove Clearance for the 587 Engine	0.05 mm (.002 in)	0.08 mm (.003 in)	(.003 in) (.008 in)
Ring / Piston Groove Clearance for the 717 and 787 Engines	0.03 mm (.001 in)	0.07 mm (.003 in)	0.20 mm (.008 in)
Ring End Gap	0.25 mm (.010 in)	0.40 mm (.016 in)	1.0 mm (.039 in)

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NOTE : Replacement cylinder sleeves are available if necessary. Also, oversize pistons of 0.25 mm (.010 in) are available for all engines and oversize pistons of 0.5 mm (.020 in) are available for the 587 and 717 engines.

Cylinder Taper

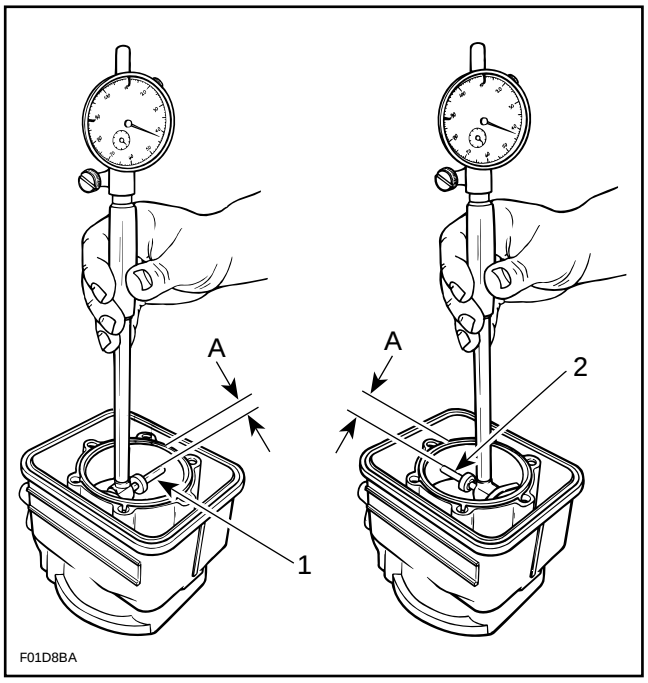
Using a cylinder bore gauge, measure cylinder diameter at 16 mm (5/8 in) from top of cylinder just below auxiliary transfer port, facing exhaust port. If the difference between readings exceed specification, cylinder should be rebored and honed or replaced.



1. Measuring perpendicularly (90°) to piston pin axis
2. Auxiliary transfer port
A. 16 mm (5/8 in)

Cylinder Out of Round

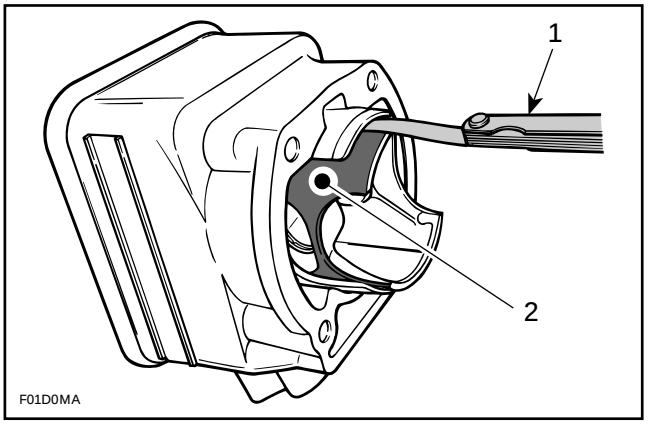
Using a cylinder bore gauge, measure cylinder diameter at 16 mm (5/8 in) from top of cylinder. Measure diameter in piston pin axis direction then perpendicularly (90°) to it. If the difference between readings exceed specification, cylinder should be rebored and honed or replaced.



1. Measuring in piston pin axis
2. Measuring perpendicularly (90°) to piston pin axis
A. 16 mm (5/8 in)

Piston / Cylinder Wall Clearance

Clearance can be quickly checked with a long feeler gauge. Insert feeler gauge in cylinder then slide piston (without piston rings installed) into cylinder as shown in the following illustration.

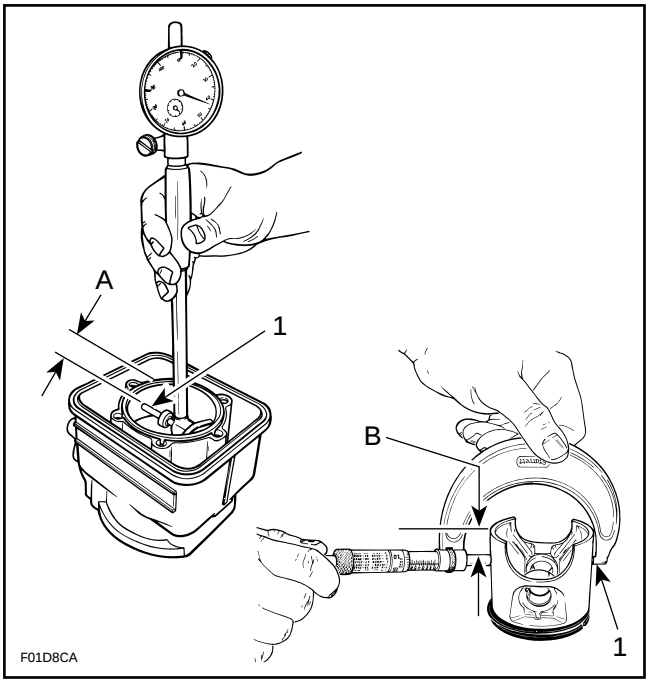


1. Feeler gauge
2. Piston

Or, to accurately determine piston to cylinder wall clearance, measure piston at 25 mm (1 in) below skirt end perpendicularly (90°) to piston pin.

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Measure cylinder at 16 mm (5/8 in) below its top edge.



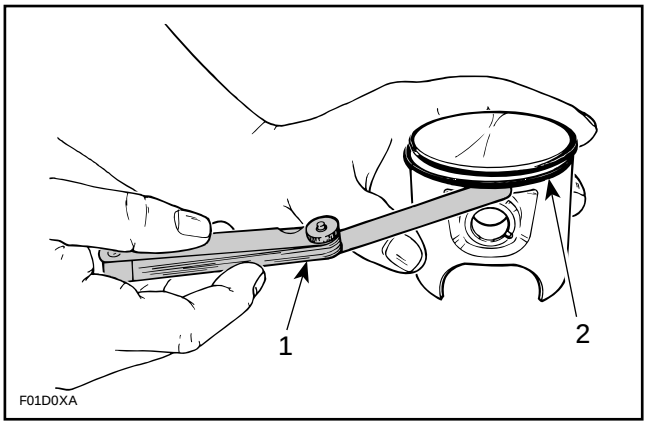
1. Measuring perpendicularly (90°) to piston pin axis
A. 16 mm (5/8 in)
B. 25 mm (1 in)

The difference between these two measurements should be within specified tolerance.

Ring / Piston Groove Clearance

Using a feeler gauge, check clearance between rectangular ring and groove. If clearance exceeds specified tolerance, replace piston.

NOTE : Ring / piston groove clearance can be correctly measured only on rectangular ring which is bottom ring.



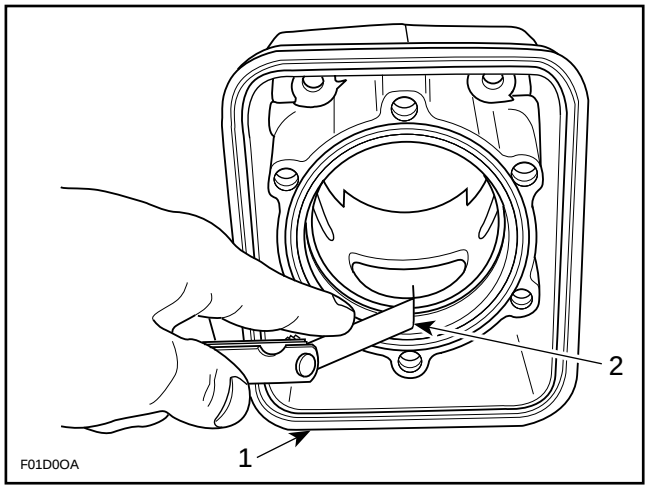
1. Feeler gauge
2. Rectangular ring (bottom)

Ring End Gap

Position ring halfway between exhaust port and top of cylinder.

NOTE : In order to correctly position ring in cylinder, use piston as a pusher.

Using a feeler gauge, check ring end gap. If gap exceeds specified tolerance, rings should be replaced.



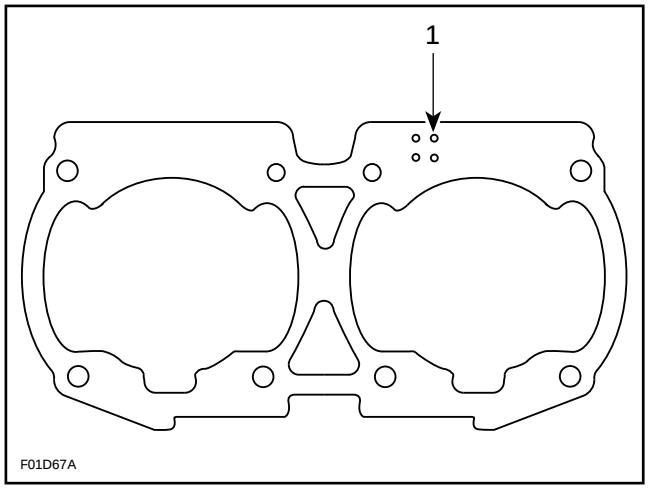
1. Top of cylinder
2. Ring end gap

16, Cylinder Base Gasket

717 and 787 Engines Only

For the 717 and 787 engines, five thicknesses of cylinder base gaskets are available for a precise adjustment of the squish gap.

To determine gasket thickness, refer to the identification holes on the gasket.



1. Identification holes

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GASKET THICKNESS	IDENTIFICATION HOLES
0.3 mm (.012 in)	3
0.4 mm (.016 in)	4
0.5 mm (.020 in)	5
0.6 mm (.024 in)	6
0.8 mm (.031 in)	8

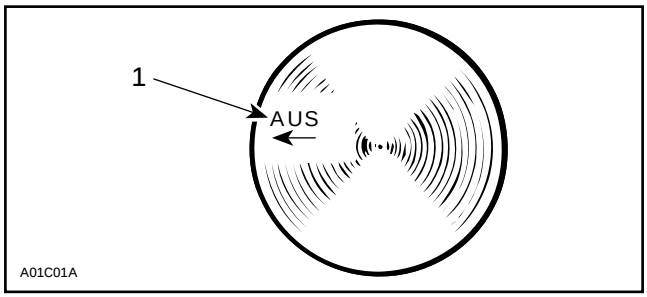
NOTE : Squish gap measurement is discussedfurther in this sub-section.

ASSEMBLY

Assembly is essentially the reverse of disassembly procedures. However pay particular attention to the following.

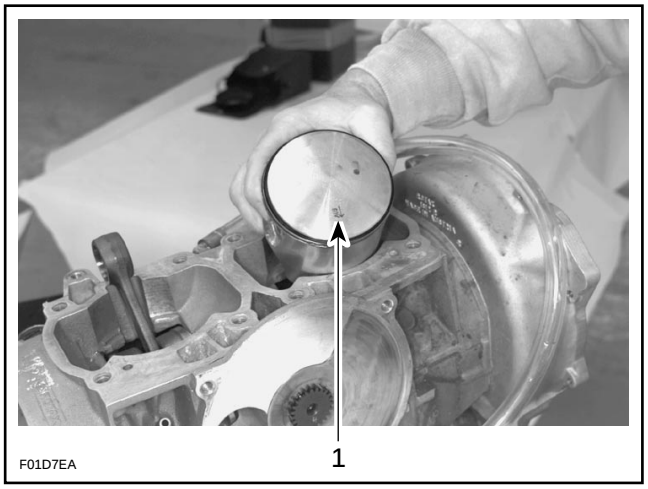
3, Piston

At assembly, place the pistons over the connecting rods with the letters "AUS" (over an arrow on the piston dome) facing in direction of the exhaust port.



1. Exhaust side

NOTE : On the 787 engine, the exhaust ports are located on the same side as the intake.



787 ENGINE SHOWN
1. "AUS"

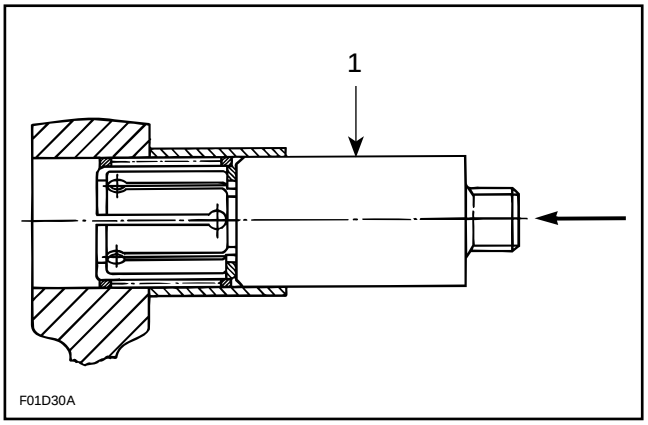
Carefully cover crankcase opening as for disassembly.

4,6, Piston Pin and Roller Bearing

717 and 787 Engines

To install roller bearing and piston pin use piston pin puller (P / N 290 877 092), proceed as follows :

– Replacement bearings are held in place by a locating sleeve outside and 2 plastic cage halves inside.
– Push needle bearing together with inner halves out of the locating sleeve into the connecting rod bore.
– Use any suitable 23 mm (.905 in) diameter pusher as a tool. Make sure thrust washers are present each side of needles.

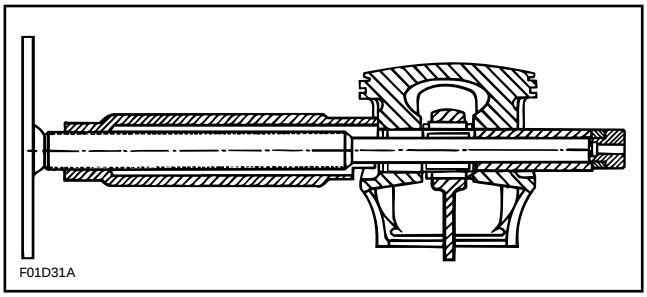


1. Pusher

– Insert piston pin into piston until it comes flush with inward edge of piston hub.

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– Warm piston to approximately 50-60°C (122-140°F) and install it over connecting rod.
– Insert extractor spindle into the piston pin, screw on extracting nut.
– Rotate handle to pull piston pin carefully into the piston.

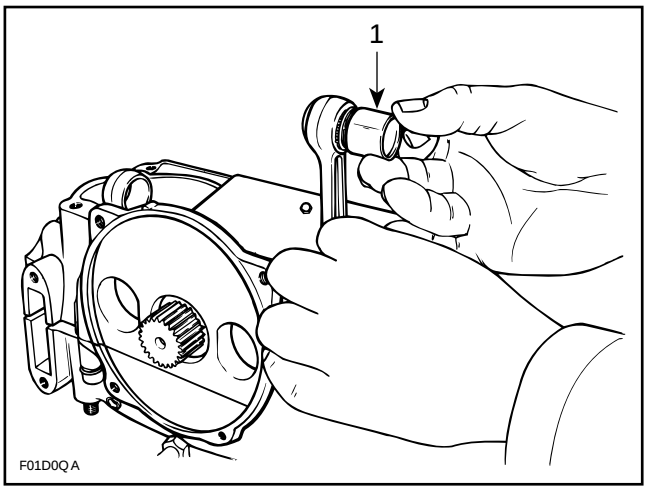


PLACTIC MOUNTING DEVICE METHOD

As an alternate method when no service tool is available proceed as follows :

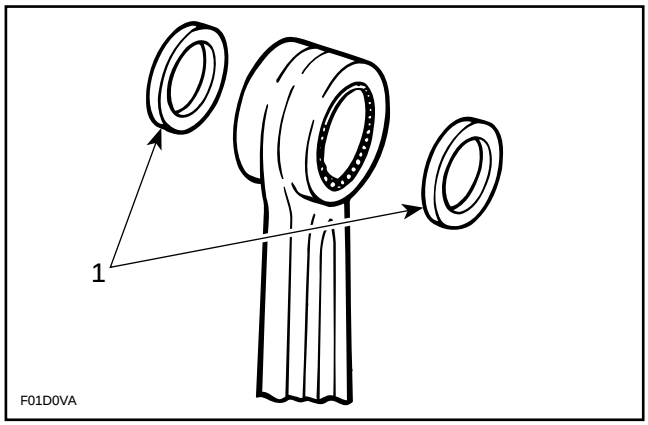
Replacement roller bearings are delivered in a convenient plastic mounting device. For installation, proceed as follows :

– Align replacement roller bearing with connecting rod bore.
– Carefully push inner plastic sleeve into connecting rod bore ; outer plastic ring will release rollers.



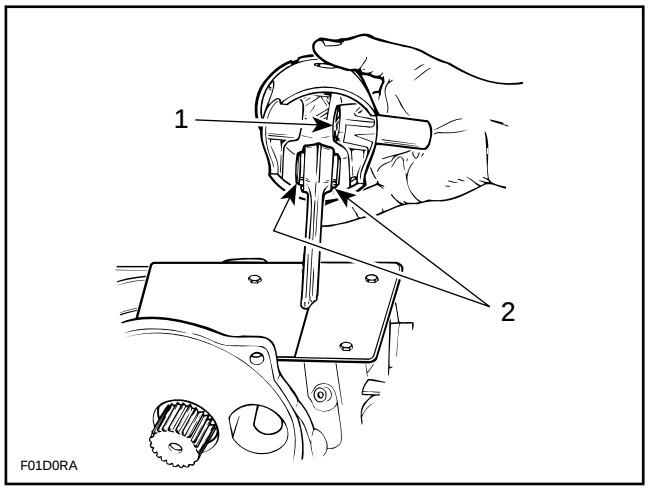
1. Outer ring removal after inner sleeve insertion into bore

– Make sure thrust washers are present each side of rollers.



1. Thrust washer each side

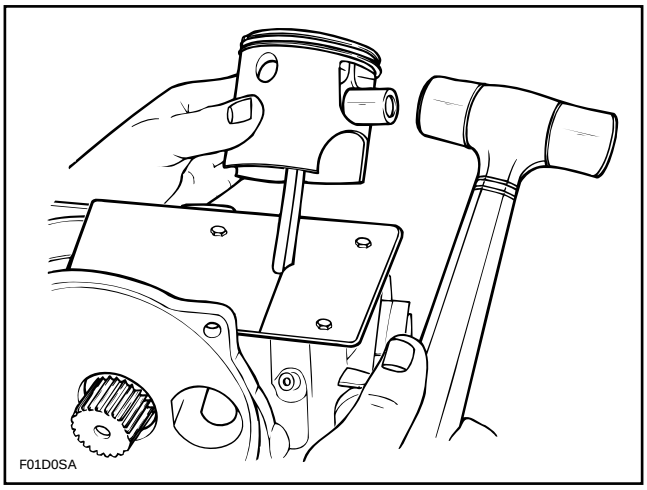
– Insert piston pin into piston until it comes flush with inward edge of piston hub.



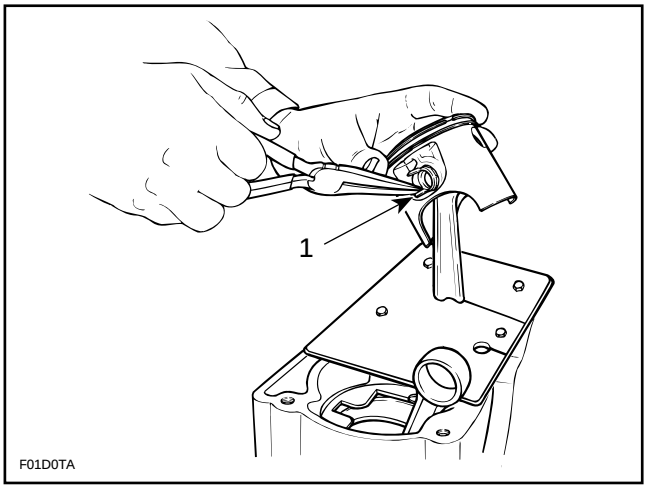
1. Piston pin flush here
2. Thrust washers

– Place piston over connecting rod and align bores, then gently tap piston pin with a fiber hammer to push out inner plastic ring on opposite side. Support piston from opposite side.

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– As necessary, pull halves of inner sleeve with long nose pliers.



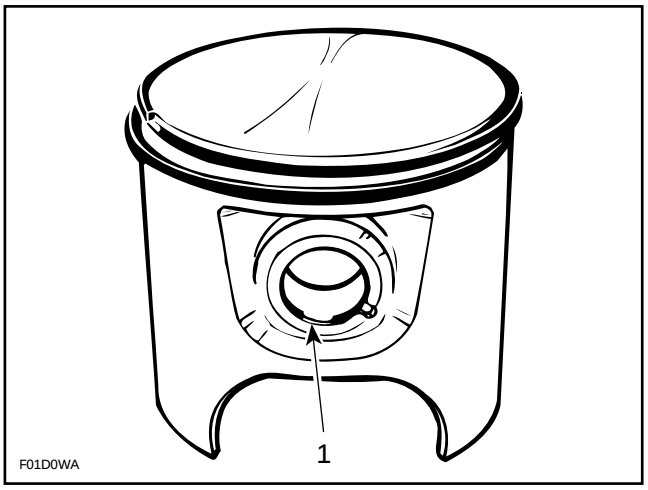
1. Pulling inner sleeve half

All Engines

5, Circlip

Secure remaining circlip taking into consideration the following.

▼CAUTION : To minimize the stress on the circlips, install them so that their openings are located at 6 o'clock (at bottom).

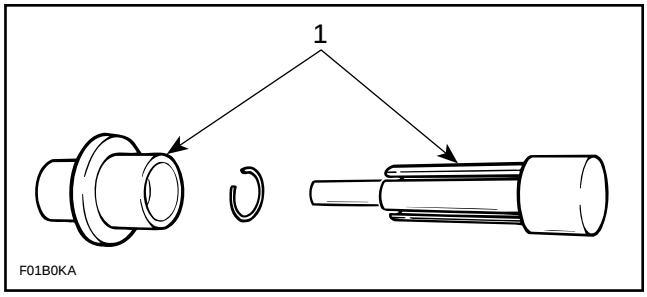


1. Circlip opening at 6 o'clock (at bottom)

◆WARNING : Always wear safety glasses when installing piston circlips.

▼CAUTION : Always use new circlips. At installation, take care not to deform them. Overstressed circlips will come loose and will damage engine. Circlips must not move freely after installation.

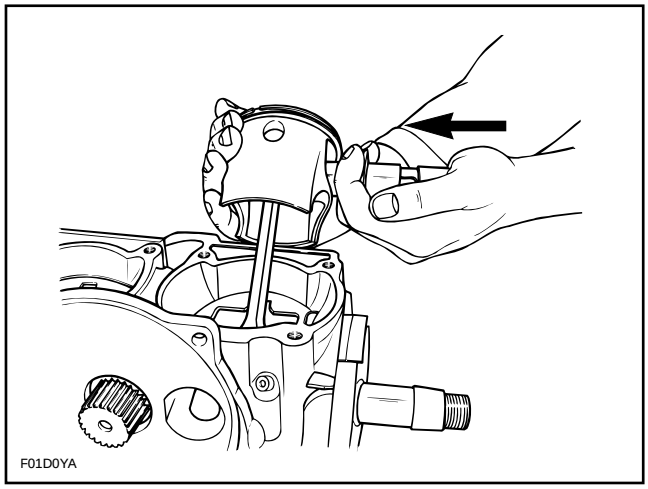
To easily insert circlip into piston, use circlip installer P / N 295 000 077 for the 587 engine or P / N 290 877 016 for the 717 and 787 engines.



1. Circlip installer

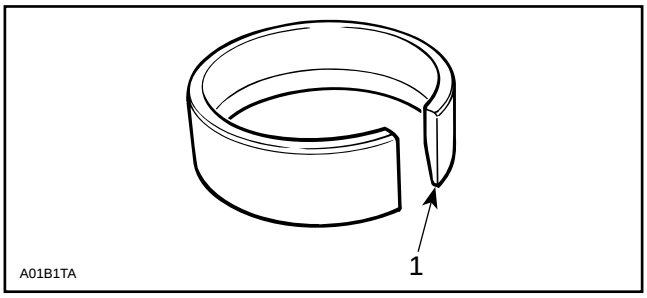
– Remove pusher from tool then insert circlip into its bore.
– Reinstall pusher into tool and push until circlip comes in end of tool.
– Position end of tool against piston pin opening.
– Firmly hold piston against tool and push tool pusher to insert circlip into its groove.

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3,7,8,9, Piston, Ring and Cylinder

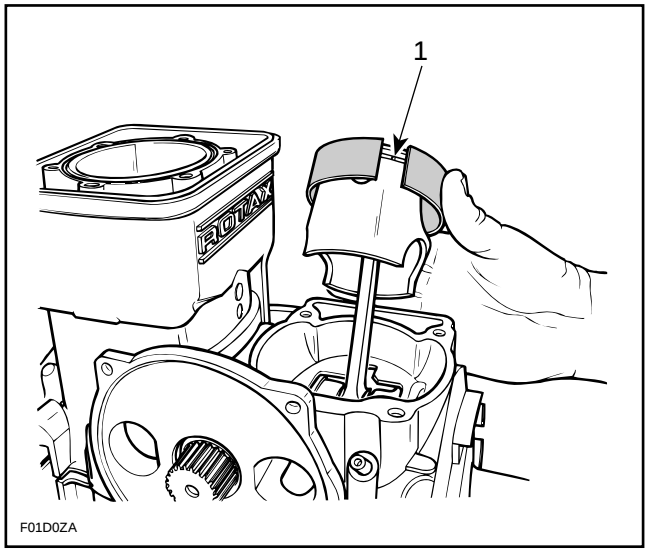
To easily slide cylinder over piston, install on piston ring compressor P / N 290 876 972 for the 587 engine or P / N 290 876 979 for the 717 and 787 engines.



1. Slide this edge

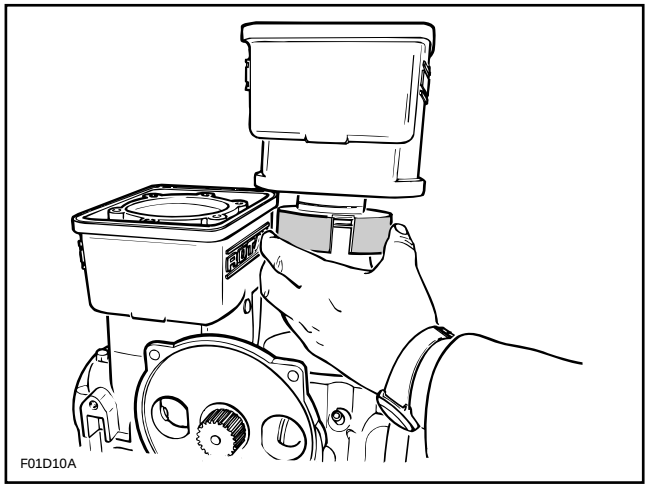
NOTE : Ring compressor will not fit on oversize parts.

Make sure to align ring end gap with piston locating pin. Slide tool over rings.



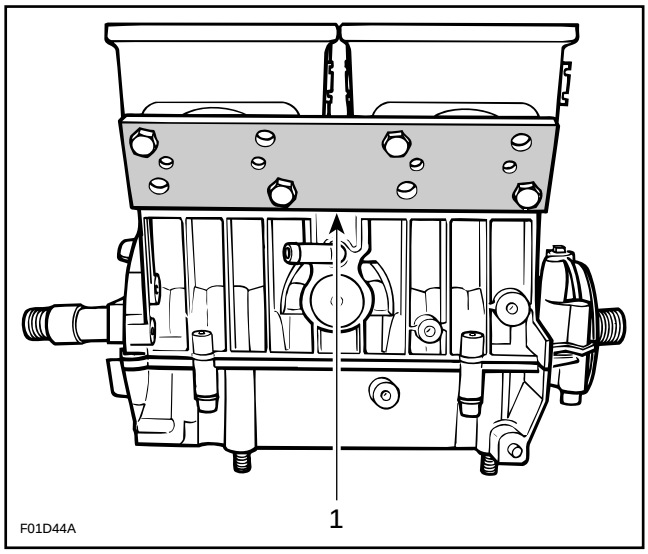
1. Ring end gap aligned with piston locating pin

Slide cylinder over piston.

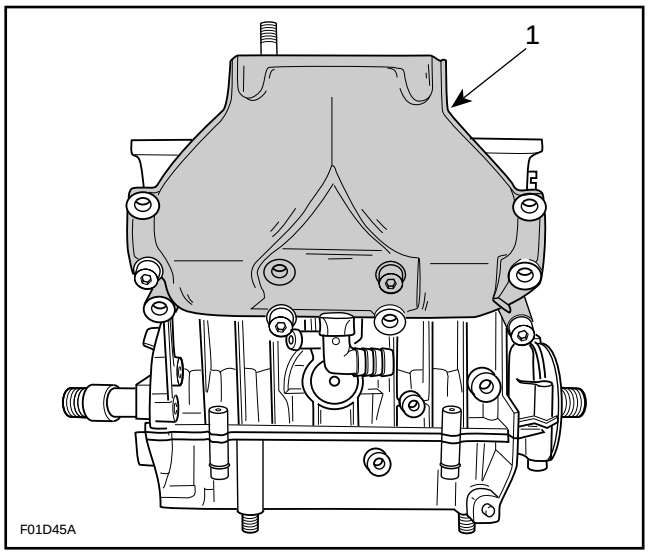


When reassembling cylinders to crankcase, it is important to have them properly aligned so that exhaust flanges properly match up with exhaust manifold. The aligning tool (P / N 290 876 902) can be used on the 587 and 717 engines, or the exhaust manifold can also be used for all engines.

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ALL ENGINES EXCEPT THE 787
1. Exhaust flange aligning tool



ALL ENGINES
1. Aligning cylinders using exhaust manifold

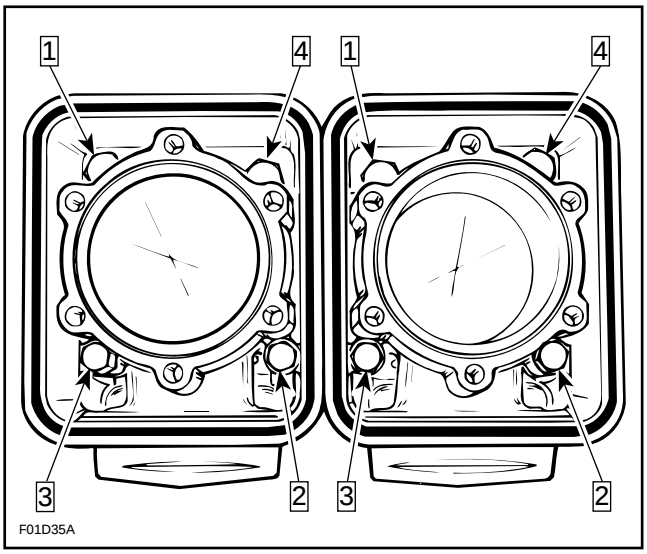
10,17,18, Cylinder Screw

587 and 717 Engines

Apply synthetic grease below the screw head.

For the 717 engine, apply also Loctite 242 (blue) on screw threads.

Install and torque screws in a criss-cross sequence for each cylinder to 24 N•m (17 lbf•ft). Refer to the following illustration.

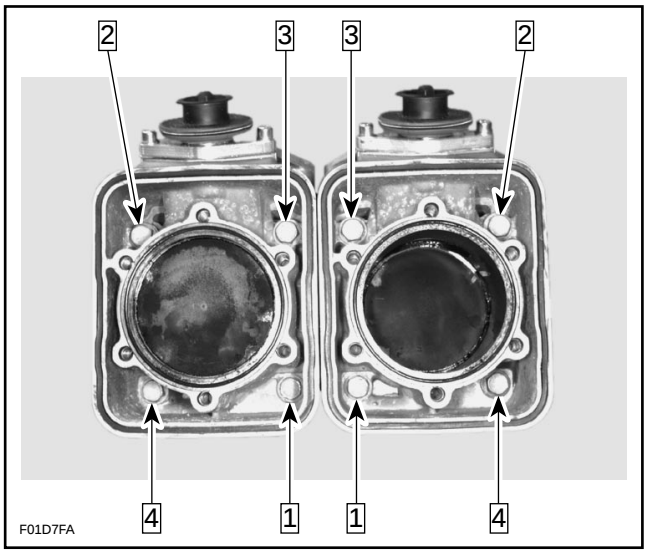


787 Engine

Prior installation, apply synthetic grease below screw head and Loctite 515 on screw threads.

Install M10 x 105 screws on exhaust side and the M10 x 73,5 on opposite side.

Torque screws in a criss-cross sequence for each cylinder to 20 N•m (15 lbf•ft). Repeat the procedure, retightening all cylinder screws to 40 N•m (30 lbf•ft).



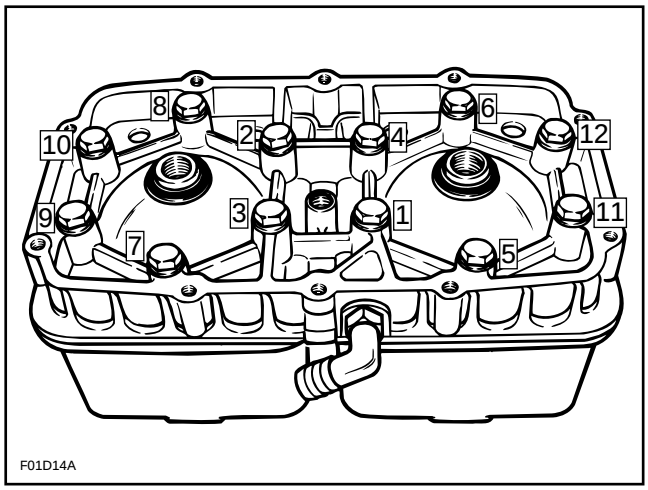
2,11,12, Cylinder Head, Screw and O-ring

587 Engine

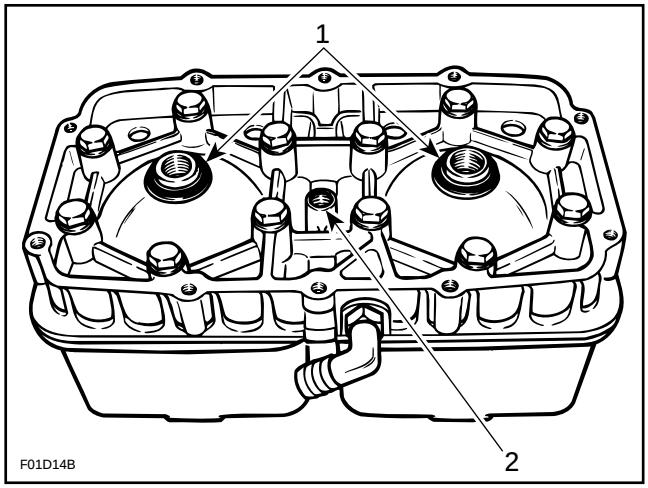
Apply synthetic grease below screw head and on screw threads.

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Apply Loctite 515 in O-ring groove of cylinder sleeves.



Make sure to install large O-rings around spark plug holes and small O-ring where shown.



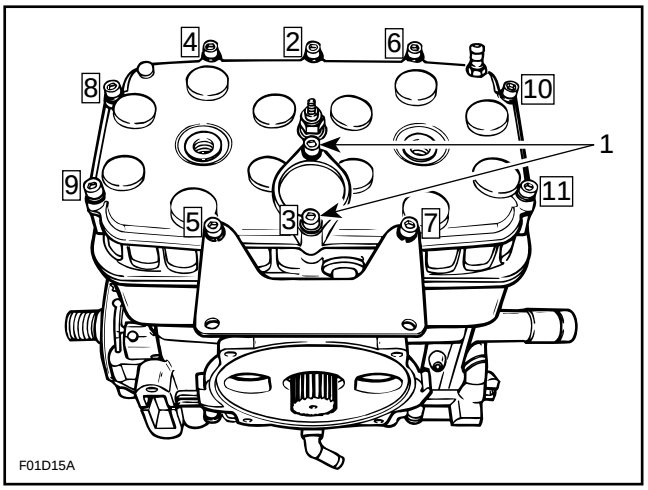
1. *Large O-rings*
2. *Small O-ring*

1,13,14, Cylinder Head Cover and Screw

587 Engine

Install cover over cylinder head. The two longer screws must be installed on oval-shaped housing. Make sure to install flame arrester support.

Torque cylinder head cover screws to 9 N•m (80 lbf•in) as per following illustrated sequence.



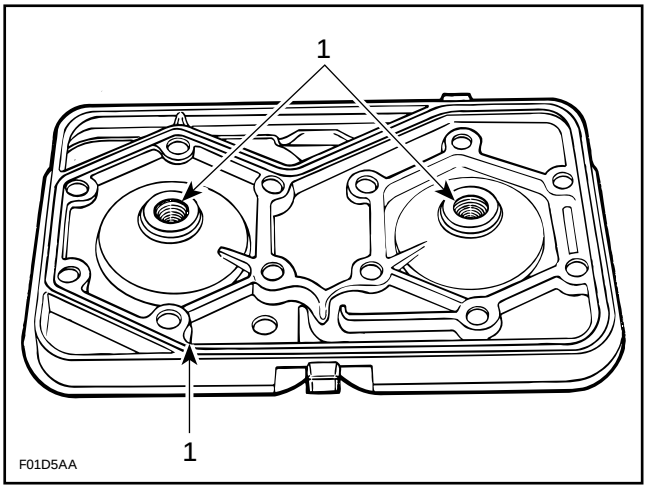
1. *Longer screws*

2,12, Cylinder Head and O-ring

717 and 787 Engines

Make sure to install O-rings around spark plug holes and O-ring of cylinder head as shown in the following illustration.

Apply Loctite 515 in O-ring groove of cylinder sleeves.



1. *O-ring*

Install cylinder head.

1,15, Cylinder Head Cover and Screw

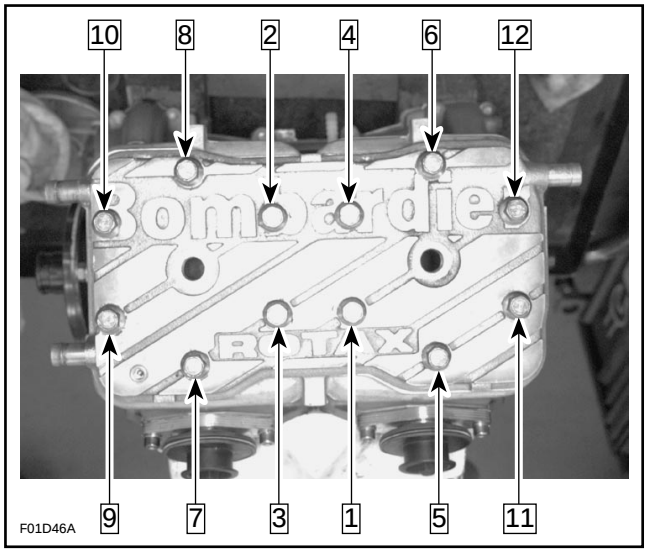
717 and 787 Engines

Install cylinder head cover.

Prior installation, apply Loctite 242 (blue) below screw head and synthetic grease on screw threads.

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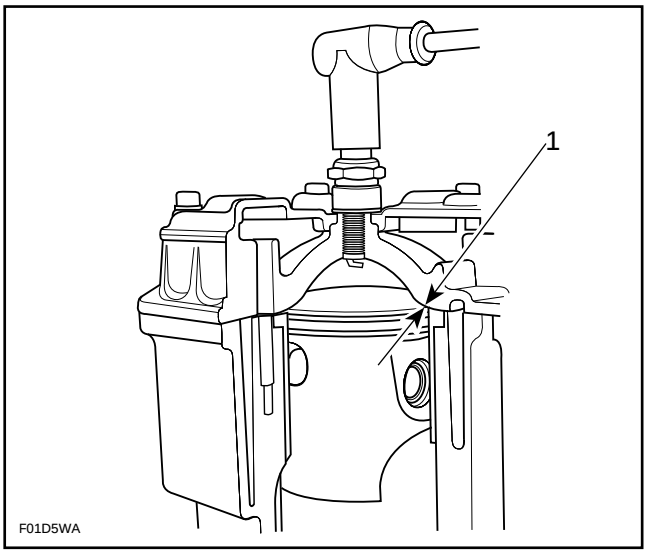
Torque cylinder head screws to 12 N•m (9 lbf•ft) as per following illustrated sequence. Repeat the procedure, retightening all screws to 24 N•m (17 lbf•ft).



SQUISH AREA

Rotax rotary valve engines incorporate a combustion chamber which feature a squish area. This area is basically a “ledge” projecting beyond combustion chamber area. In operation, as the piston ascends and approaches the ledge, a rapid squeezing action is applied to the air / fuel mixture contained in the area immediately between the piston dome and the ledge. This squishing action forces the entrapped mixture rapidly into the combustion chamber area, creating a greater mixture turbulence. Additionally, the small volume and large surface area of the squish band allow a better cooling of the end gases to help prevent detonation.

▼ CAUTION : When reassembling an engine, always measure squish gap to make sure it is within the specified tolerance.



1. Squish gap

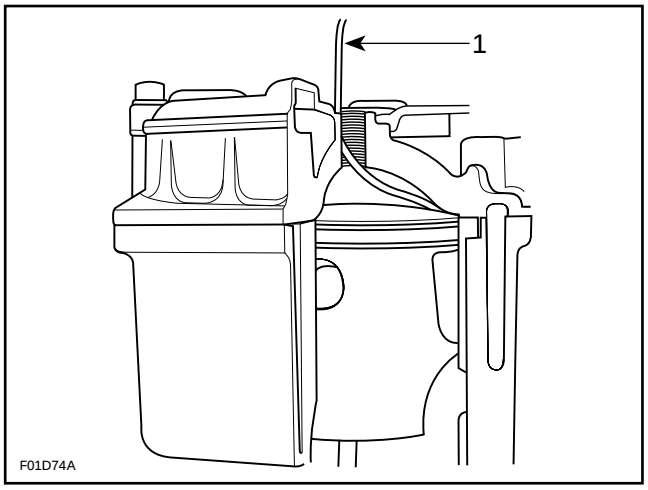
If the squish gap is increased, a loss in power will occur, while too small a squish gap will lead to detonation.

Squish Gap Measurement

The squish gap can be measured by inserting a piece of resin core solder into the combustion chamber.

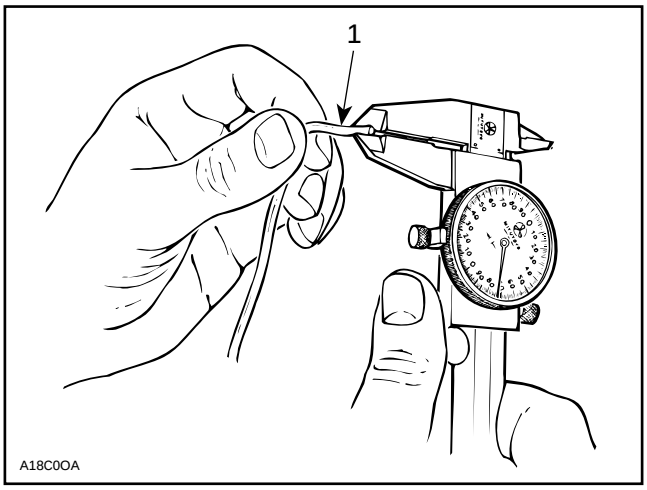
– Insert solder in combustion chamber.
– Rotate the engine through Top Dead Center ; remove the solder and measure the thickness of the compressed solder.

○ NOTE : The solder should be inserted above and in line with the wrist pin.



1. Solder

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1. Measure here

▼CAUTION : Do not use acid core solder ; the acid can damage the piston and cylinder.

– Take another measurement at the opposite side of the piston.

– Repeat procedure for the other cylinder.

The lowest and the highest values of both cylinders must be within the specified range.

Engine	Squish Gap
587	1.2 - 1.8 mm (.047 - .071 in)
717	1.3 - 1.7 mm (.051 - .067 in)
787	1.2 - 1.6 mm (.047 - .063 in)

If adjustment is required, replace cylinder base gasket accordingly, using a thicker or thinner one.

RAVE SYSTEM

Theory

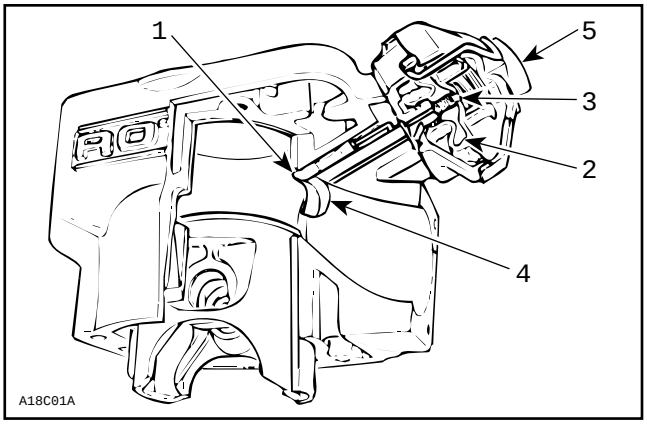
For a 2-stroke-cycle engine to have high power capacity at high crankshaft speeds, a high volumetric or breathing efficiency is required and the fresh charge losses must be minimized. The result is achieved by opening the exhaust port early and utilizing the resonant effects of the tuned exhaust system to control fresh charge losses.

When an engine of this design is run at a medium speed, efficiency falls off quickly. The relatively high exhaust port effectively shortens the useful power stroke and because the exhaust system is tuned for maximum power, there is a large increase of fresh charge losses. As a result, the torque decreases along with a dramatic increase of the specific fuel consumption. Higher torque along with lower fuel consumption can be obtained at lower engine speeds if the time the exhaust port is open is shortened.

Bombardier-Rotax has patented a remarkably simple system to automatically change the exhaust port height based on pressure in the exhaust system.

Located above the exhaust port is a guillotine-type slide valve. This rectangular valve is connected by a shaft to a diaphragm which is working against the return spring. One small passage in the cylinder just outside the exhaust port allows exhaust gas pressure to reach the diaphragm.

To the outside of the return spring is a red plastic adjustment knob. Turning the adjustment in or out changes the preload on the return spring which, in turn, will change the RPM at which the RAVE valve opens and closes.

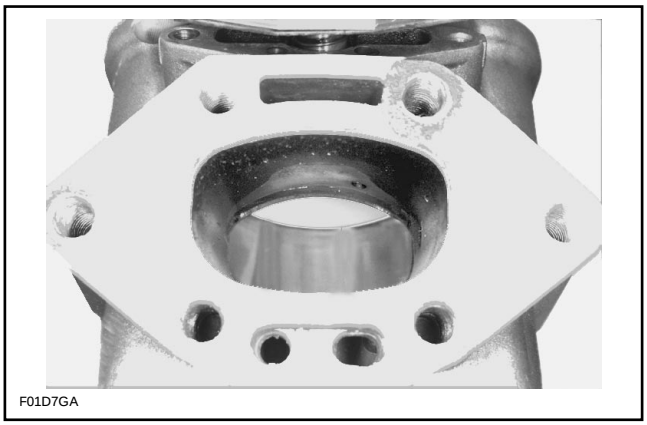


TYPICAL

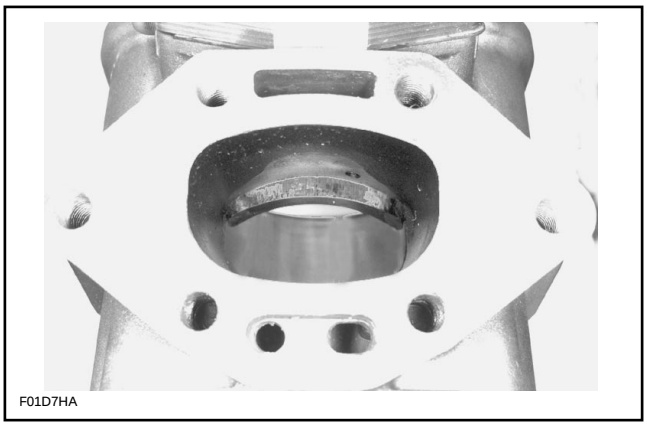
1. Slding valve
2. Diaphragm
3. Spring
4. Exhaust port
5. Adjustment knob

As the throttle is opened and the engine begins producing more power, the pressure against the diaphragm will overcome the pressure of the return spring and the RAVE valve will open.

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F01D7GA

VALVE FULLY OPENED


F01D7HA

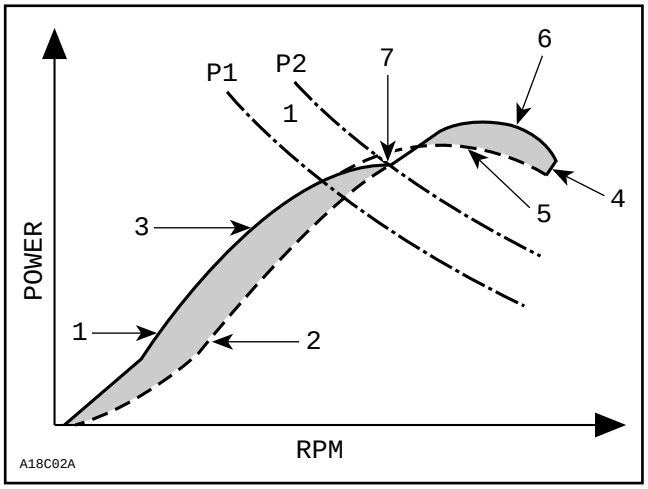
VALVE FULLY CLOSED

The RAVE valve does not allow an engine to make higher peak horsepower than an engine not so equipped, it can make moving the peak higher practical because of its effect on the rest of the power curve. Item 2 in the following figure is the power curve of an engine with the RAVE valve held fully open through its entire RPM range. Item 6 notes the peak power produced. That peak will not change if the exhaust port time of a similar engine without a RAVE valve was the same (with all other features equal).

Item 1 is the power curve of the engine with the RAVE valve closed through its entire RPM range. The shaded area (item 3) is the improvement in power at lower engine speeds that is gained because of the lower exhaust port. If the port remains at this height, however, the power would peak as noted in item 5. Raising the exhaust port at the proper RPM (item 7) will allow the engine peak power to continue to rise (item 6).

Item P1 in figure is the pressure of the return spring against the diaphragm. The exhaust pressure must be high enough to overcome this pressure before the valve begins opening. Item P2 is the pressure required to completely open the RAVE valve. Between P1 and P2, the usable power curve of the engine is moving from power curve 1 to power curve 2. This transition takes place very rapidly at full throttle and from a practical standpoint can be considered to be instantaneous at item 7. Gradual application of the throttle, however, will result in the RAVE valve opening much later.

If the RAVE valve opens too late, the engine will bog or hesitate momentarily as the RPM increases. Full peak performance (item 6) is still available. From a functional point of view. It is better to have the valve open a bit early than a bit late.



Maintenance

There are no wear parts anywhere in the system and there are no adjustments to be periodically checked. The only possible maintenance required would be cleaning of carbon deposits from the guillotine slide. Cleaning intervals would depend upon the user's riding style and the quality of the oil used. Using FORMULA XP-S synthetic injection oil, we would suggest annual cleaning of the valve. If a customer uses a lower quality oil, more frequent cleaning may be required.

No special solvents or cleaners are required when cleaning the valve.

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Boring Precaution

In its stock configuration the RAVE valve guillotine has a minimum of 0.5 mm (.020 in) clearance to the cylinder bore measured at the center line of the cylinder. This is the minimum production clearance.

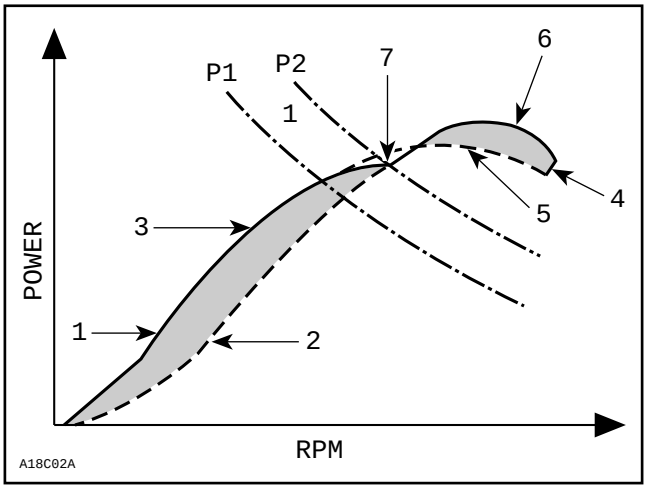
There is only a first oversize piston available for the 787 engine. That piston is 0.25 mm (.010 in) larger in diameter than the stock piston. When the oversize is installed, the guillotine will have a minimum clearance of 0.375 mm (.015 in) with the cylinder bore. This is the minimum operating clearance the guillotine should be used with. Clearance less than 0.375 mm (.015 in) will require reworking of the guillotine to achieve the proper clearance and radius.

Disassembly

19,20, Spring and Cover

Remove the cover of the valve by releasing the spring.

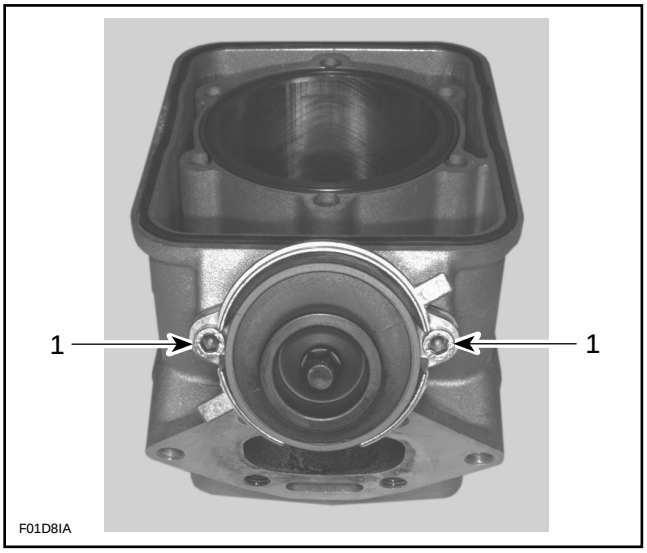
◆ WARNING : Firmly hold cover to valve base. The spring inside the valve is applying a pressure against the cover.



1. Spring

21, Allen Screw

Loosen Allen screws and remove RAVE valve.



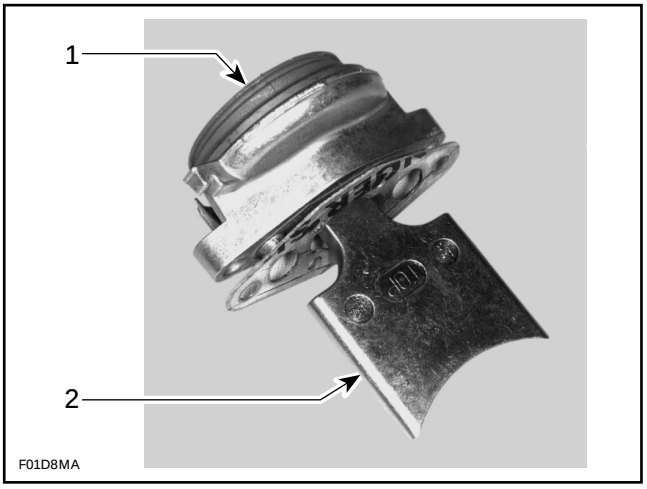
1. Allen screws

22,23,24, Valve Piston, Bellow and Sliding Valve

Remove bellow from valve piston.

Unscrew valve piston from sliding valve.

○ NOTE : Hold the sliding valve to prevent it from turning.



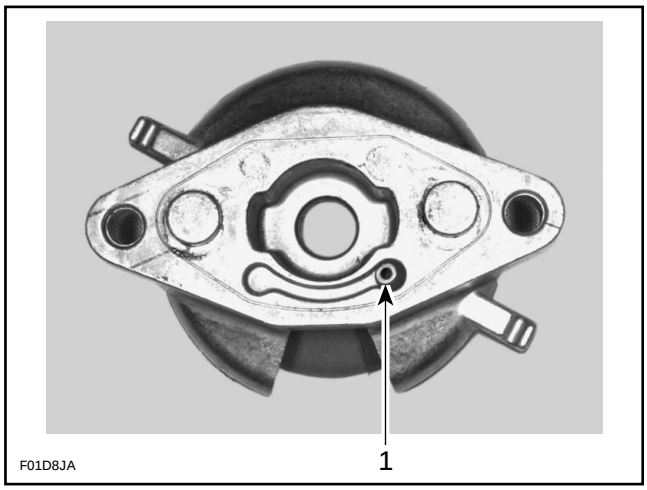
1. Unscrew piston
2. Hold sliding valve

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Inspection

Check bellow for cracks.

Check if passages of valve housing and cylinder are not obstructed.



1. Passage of valve housing

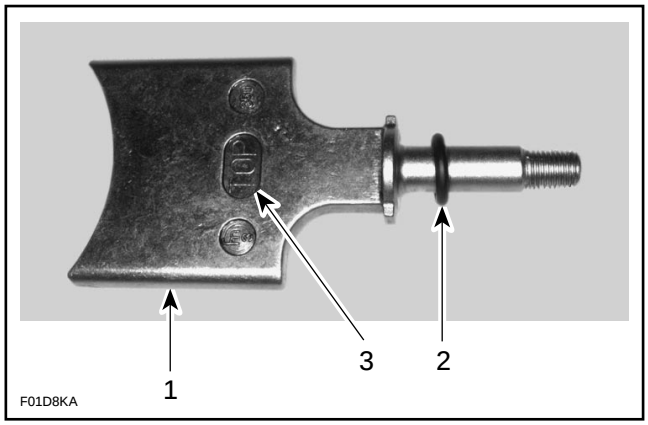
Assembly

Assembly is essentially the reverse of disassembly procedure. However, pay particular attention to the following.

24,25, Sliding Valve and O-ring

Make sure to insert O-ring onto rod of sliding valve.

The TOP position of the sliding valve is indicated on one side.



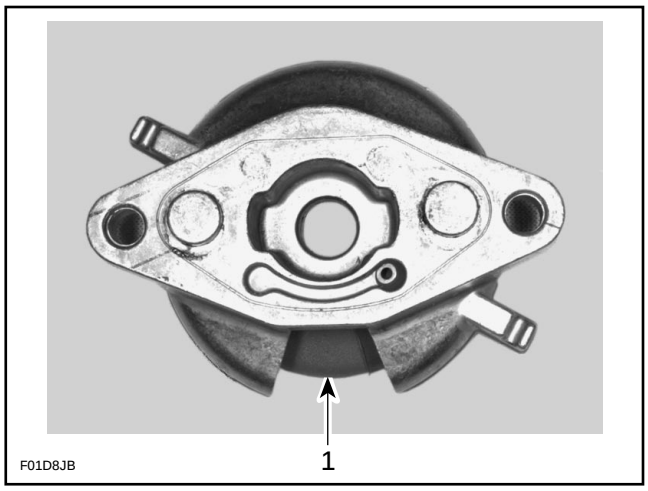
1. Sliding valve
2. O-ring
3. "TOP"

26, Gasket

Install a new gasket. It must be installed at the same time as the sliding valve.

27, Valve Housing

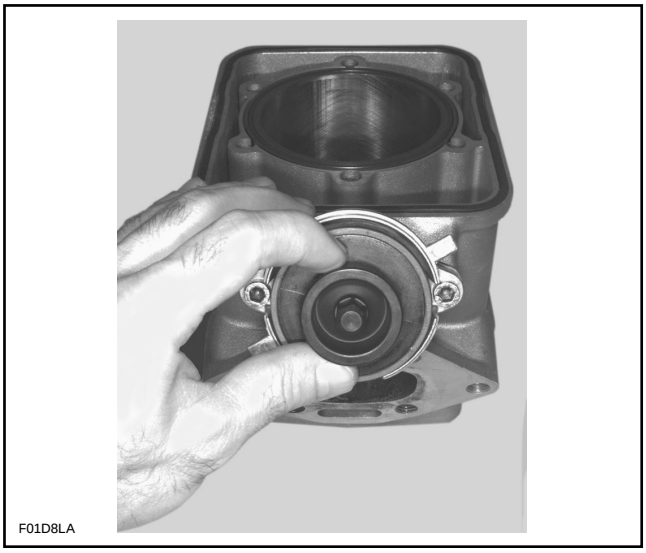
Position the valve housing onto the cylinder so that its opening is toward the bottom.



1. Bottom of valve housing

22,24, Valve Piston and Sliding Valve

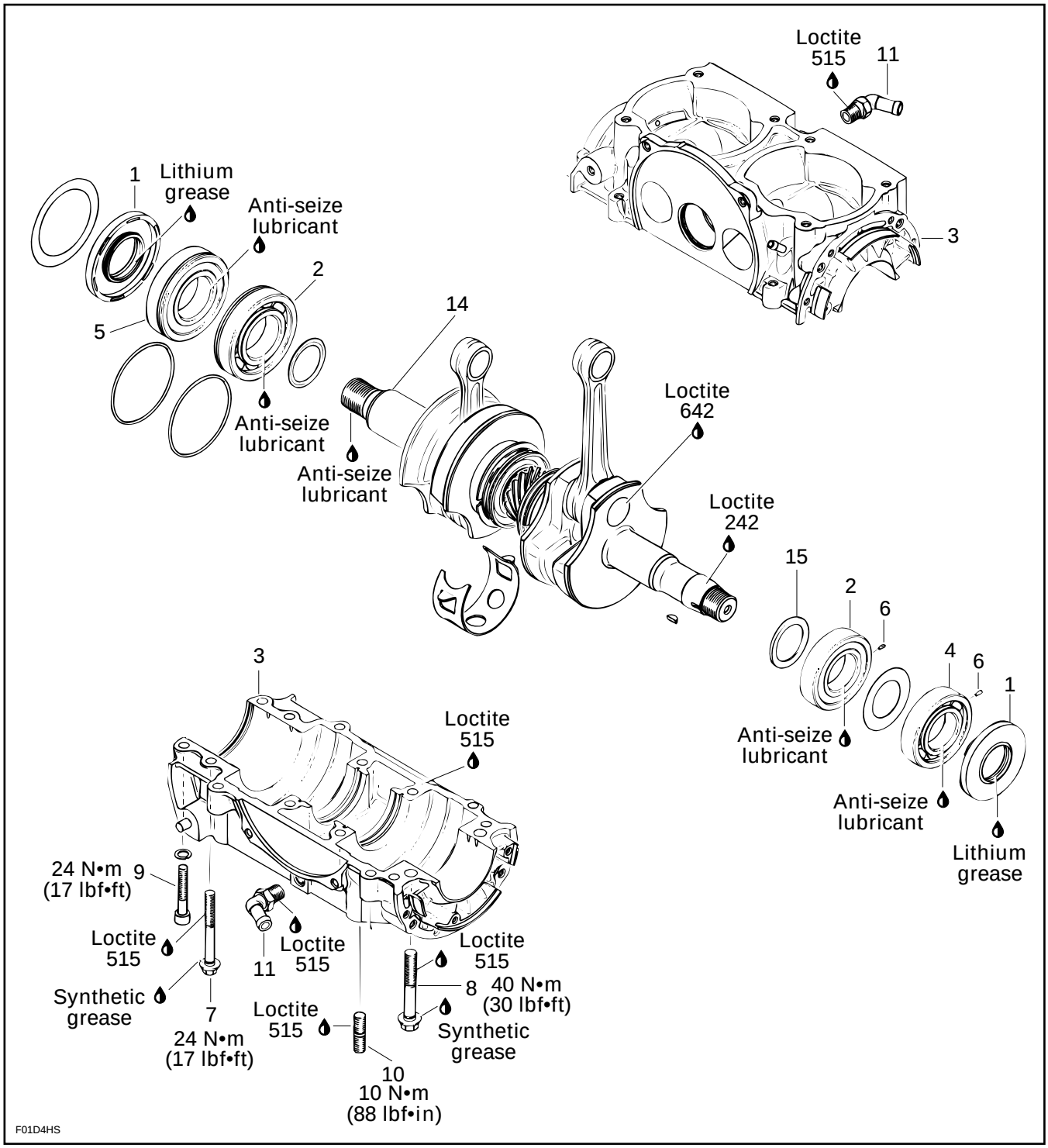
When the valve is mounted onto the cylinder, move the valve piston to ensure the sliding valve moves easily and doesn't stick.



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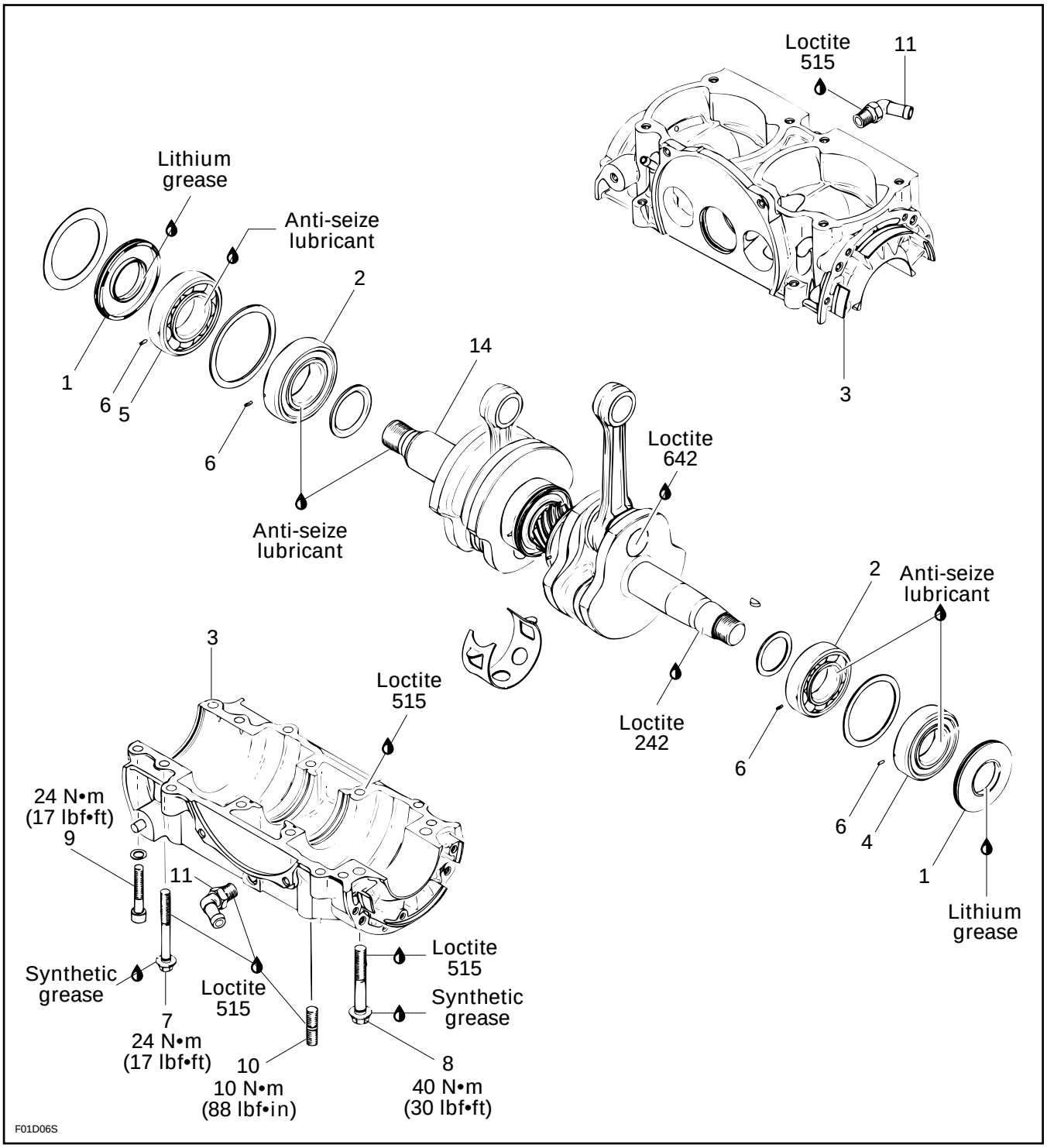
BOTTOM END

587 Engine



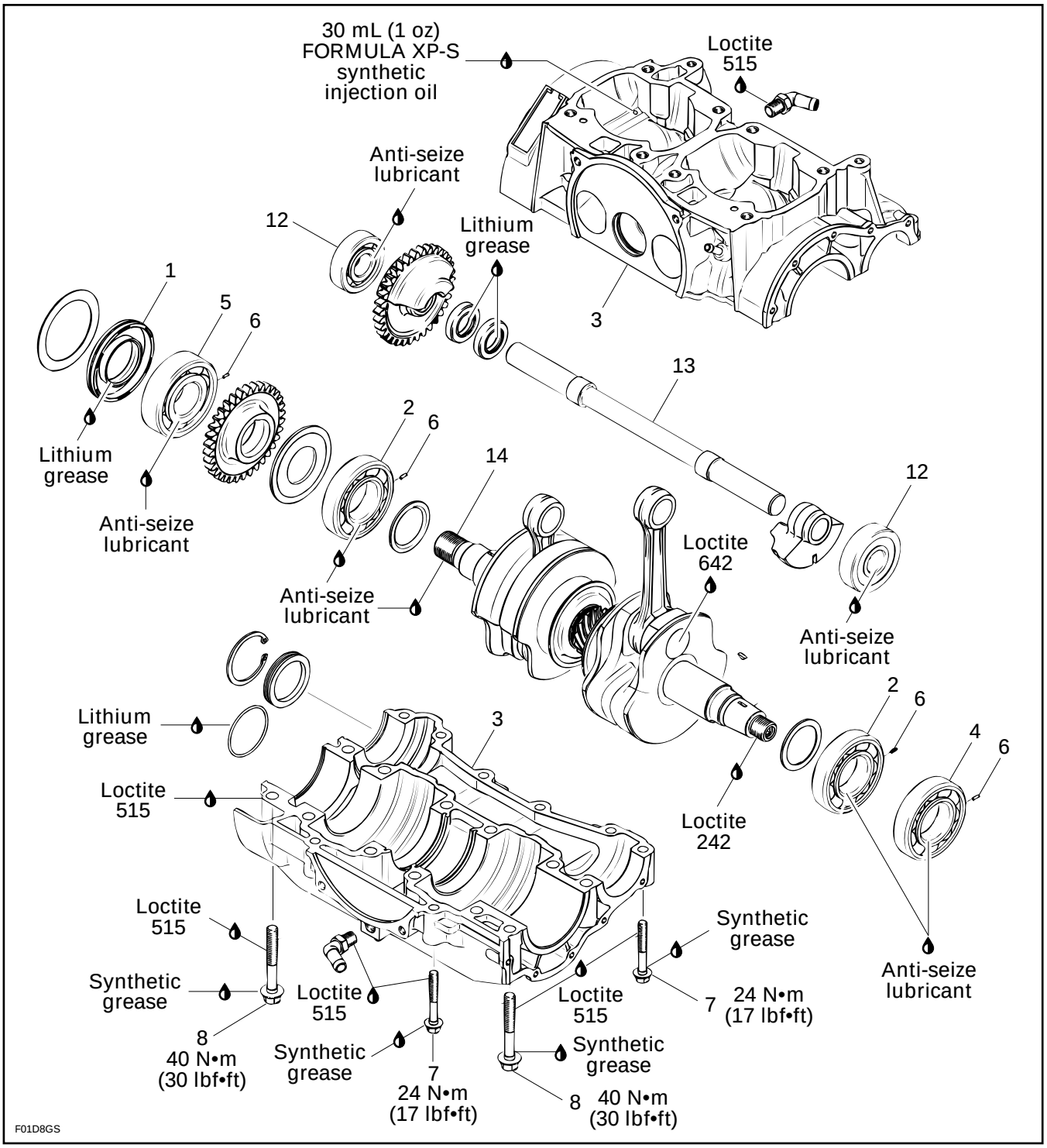
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717 Engine



PARTS
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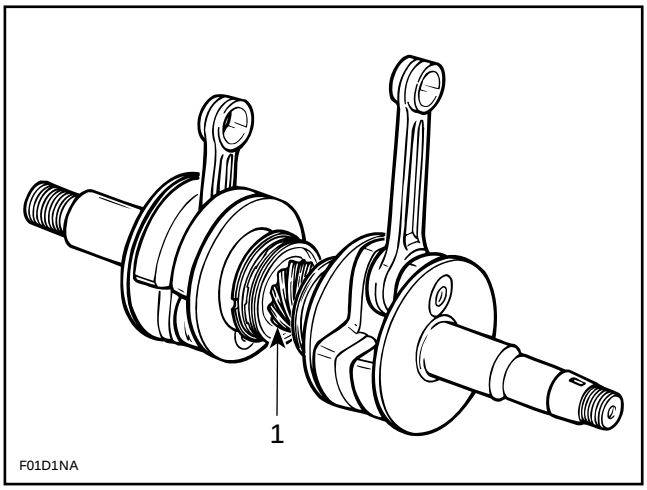
787 Engine



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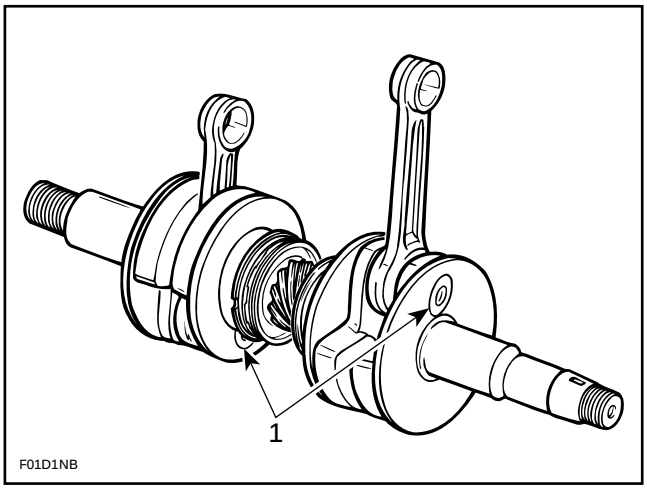
CRANKSHAFT MISALIGNMENT AND DEFLECTION

Since it is an assembled crankshaft it can become misaligned or deflected. Crankshaft can be twisted on center main journal, changing timing of one cylinder in relation with the other.



1. Main journal alignment here

Counterweights can also be twisted on connecting rod journal on any or both cylinder(s).



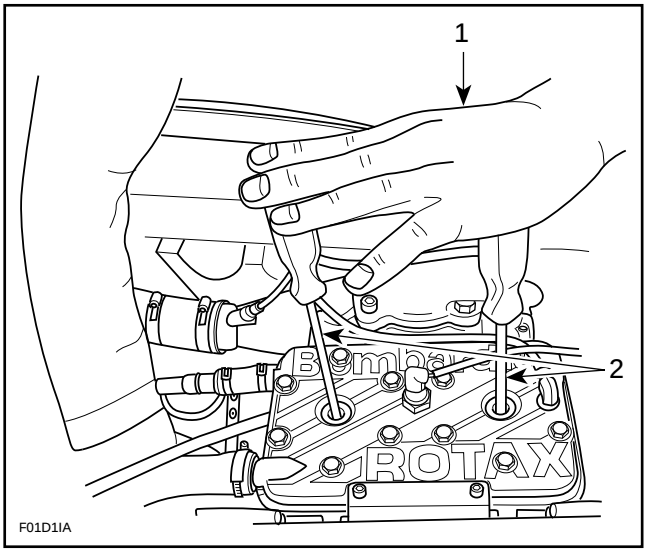
1. Connecting rod journal alignment here

Crankshaft Alignment at Center Main Journal

NOTE : The following checks can be performed with engine in watercraft without overhauling engine.

To quickly check, without accuracy, if crankshaft is twisted on center main journal, proceed as follows :

– Remove PTO flywheel guard.
– Remove spark plugs.
– Insert a screwdriver in one spark plug hole.
– Insert a longer screwdriver in the other spark plug hole.
– Lay one hand over both screwdriver handles to feel piston displacements.
– With the other hand, slowly rotate engine by PTO flywheel.



TYPICAL

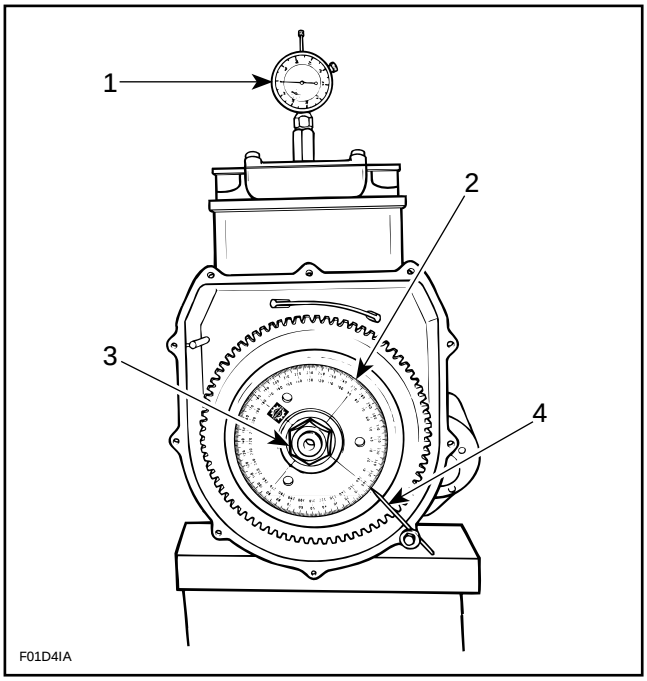
1. Lay one hand over screwdrivers to feel movement
2. Screwdrivers in spark plug holes

As soon as one piston starts going up, the other must immediately go down. Any interval between strokes indicates a misaligned crankshaft.

Or, to accurately check crankshaft alignment, proceed as follows :

– Remove ignition housing cover.
– Remove flywheel nut (and magneto rotor for the 787 engine). Refer to ELECTRICAL SYSTEM 08-01 for procedures.
– Install Bombardier degree wheel (P / N 295 000 007) on crankshaft end. Hand-tighten nut only.
– Remove both spark plugs.
– Install a TDC gauge in spark plug hole on MAG side.
– Bring MAG piston at Top Dead Center.
– As a needle pointer, secure a wire with a cover screw and a washer.
– Rotate degree wheel (NOT crankshaft) so that needle pointer reads 360°.

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1. TDC gauge
2. Degree wheel
3. Hand tighten nut
4. Needle pointer

– Remove TDC gauge and install on PTO side.

– Bring PTO piston at Top Dead Center.

Interval between cylinders must be exactly 180° therefore, needle pointer must indicate 180° on degree wheel (360° - 180° = 180°).

Any other reading indicates a misaligned crankshaft.

Crankshaft Alignment at Connecting Rod Journal

Such misalignment may cause a crankshaft hard to be manually turned. Verification can be done by measuring deflection each end of crankshaft. Refer to Inspection paragraph.

If deflection is found greater than specified tolerance, this indicates worn bearing(s), bent and / or disaligned crankshaft.

DISASSEMBLY

Engine has to be removed from watercraft to open bottom end. Refer to ENGINE 04-01.

1, Seal

If crankshaft end seal(s) has / have to be replaced, bottom end must be opened (except for the MAG side seal on the 787 engine, which is mounted on the ignition housing).

3, Crankcase

Remove the following parts :

– Engine support (except for the 787 engine).

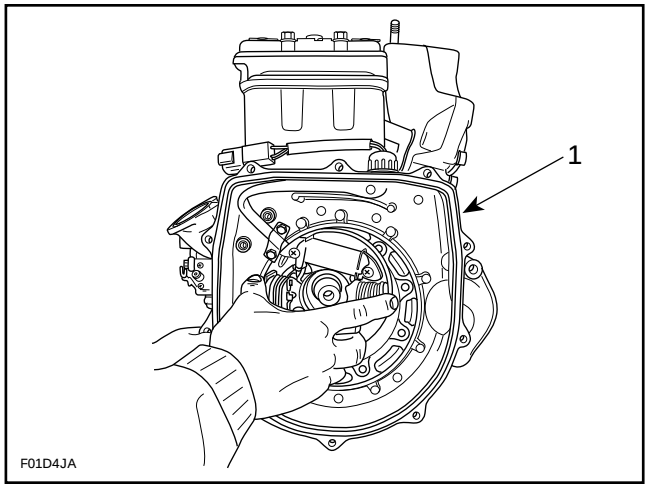
– PTO flywheel. Refer to PROPULSION SYSTEM 09-02.

NOTE : PTO side flywheel must be removed prior removing MAG side flywheel.

– Magneto flywheel. Refer to ELECTRICAL SYSTEM 08-01.

– Starter.

– Ignition housing.



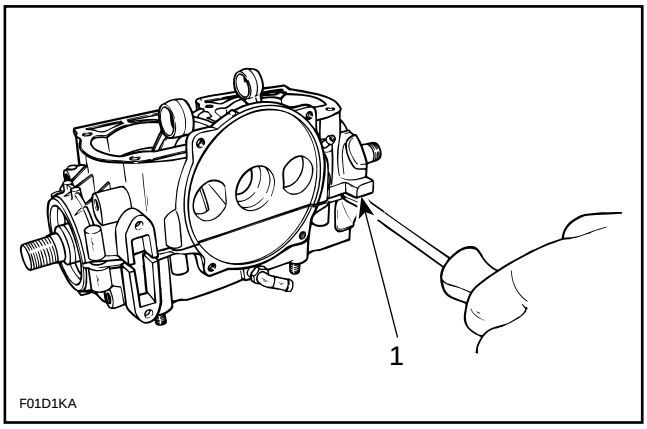
1. Separating ignition housing / armature plate from cranckcase

– Rotary valve cover and valve.

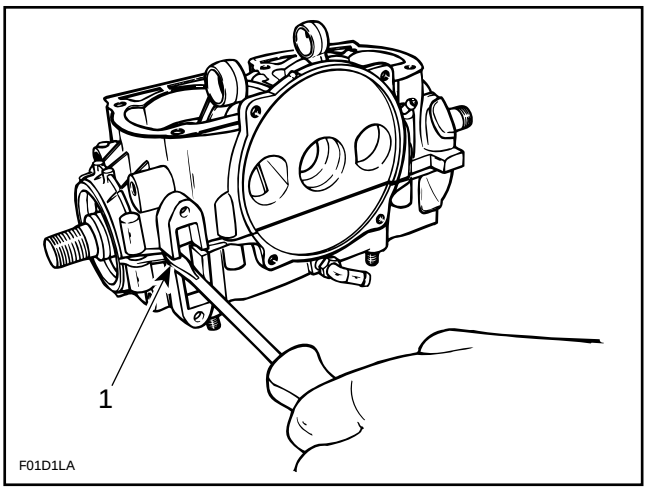
– Crankcase retaining screws.

Insert screwdrivers between crankcase lugs and pry to separate halves being careful not to damage precision machined surfaces.

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1. Separate halves by prying at provided lugs



1. Separate halves by prying at provided lugs

Remove crankshaft and counterbalance shaft (787 engine).

1,2,4,5, Seal and Bearing

NOTE : Do not needlessly remove crankshaft bearings.

Remove end seal(s).

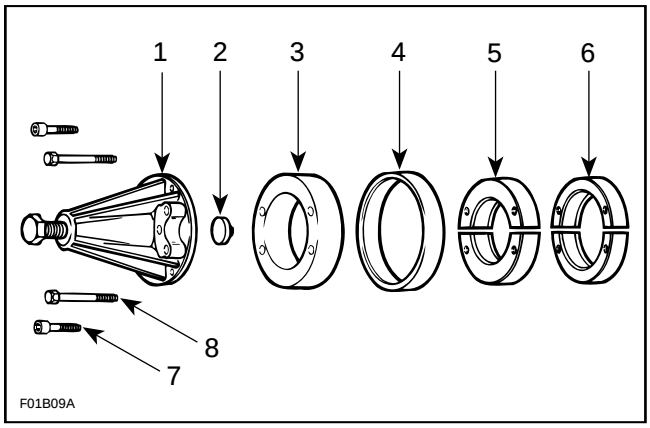
To remove end bearings from crankshaft, use protective cap (P / N 290 876 557) and puller (P / N 290 876 298).

587 and 717 Engines

On PTO side, use ring (P / N 290 977 490) with ring halves (P / N 290 977 475).

On MAG side, use distance ring (P / N 290 876 569), ring (P / N 290 977 490) with ring halves (P / N 290276 025).

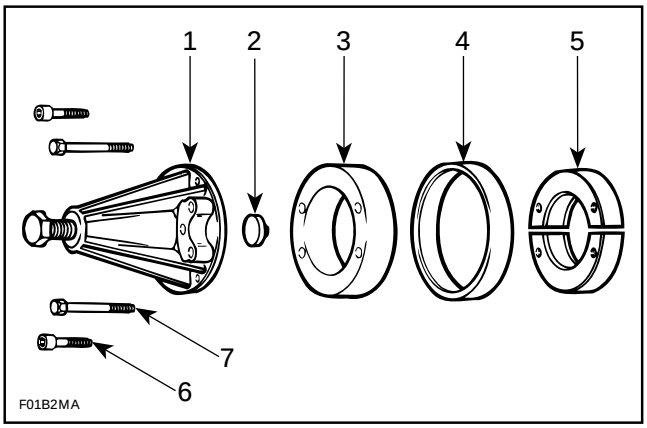
NOTE : To facilitate ring or distance ring installation lubricate their inside diameters.



1. Puller (P / N 290 876 298)
2. Protective cap (P / N 290 876 557)
3. Distance ring, MAG side (P / N 290 876 569)
4. Ring (both side) (P / N 290 977 490)
5. MAG side ring halves (P / N 290 276 025)
6. PTO side ring halves (P / N 290 977 475)
7. Screw M8 x 40 (P / N 290 840 681)
8. Screw M8 x 70 (P / N 290 841 201)

787 Engine

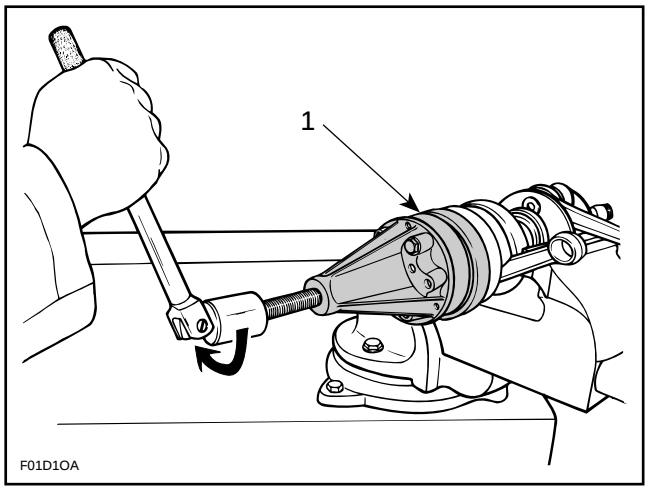
For MAG and PTO sides, use distance ring (P / N 290 876 569), ring (P / N 290 977 490) and ring halves (P / N 290 276 025).



1. Puller (P / N 290 876 298)
2. Protective cap (P / N 290 876 557)
3. Distance ring (P / N 290 876 569)
4. Ring (P / N 290 977 490)
5. Ring halves (P / N 290 276 025)
6. Screw M8 x 40 (P / N 290 840 681)
7. Screw M8 x 70 (P / N 290 841 201)

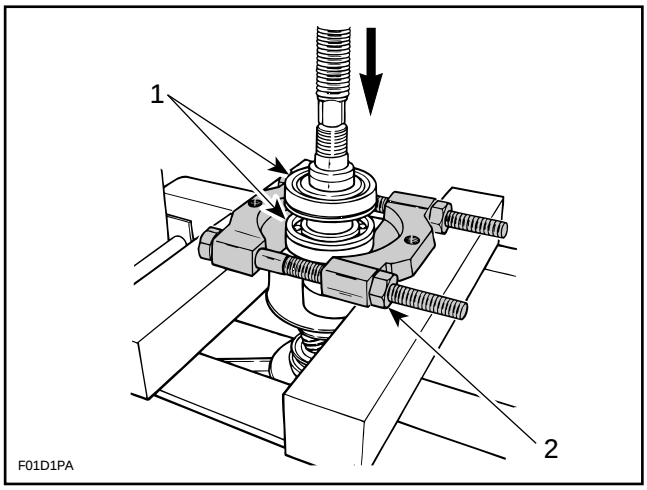
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All Engines



1. Removing crankshaft bearing

Or, use a bearing extractor such as Proto no. 4332 and a press to remove two bearings at a time.



1. Press bearings out
2. Bearing extractor

12,13, Bearing and Counterbalance Shaft

787 Engine

Bearings can be removed by using puller (P / N 290 876 298), ring halves (P / N 290 876 330) and ring (P / N 290 977 480).

If gear or oil seals need servicing, counterbalance shaft must be factory repaired.

CLEANING

Discard all oil seals, gaskets, O-rings and sealing rings.

Clean oil passages and make sure they are not clogged.

Clean all metal components in a solvent.

Remove old Loctite from crankcase mating surfaces with gasket remover (P / N 295 000 110).

▼CAUTION : Be careful not to spray cleaner on the painted surface of the engine. Never use a sharp object to scrape away old sealant as score marks incurred are detrimental to crankcase sealing.

INSPECTION

Visually inspect parts for corrosion damage.

Inspect plane surfaces for warpage. Small deformation can be corrected by grinding surface with a fine sand paper. Install sand paper on a surface plate and rub part against oiled sand paper.

Inspect crankshaft bearings. Check for scoring, pitting, chipping or other evidence of wear. Make sure plastic cage is not melted. Rotate and make sure they turn smoothly.

If crankshaft and / or components are found defective, it must be repaired by a specialized shop or replaced.

The inspection of engine bottom end should include the following measurements :

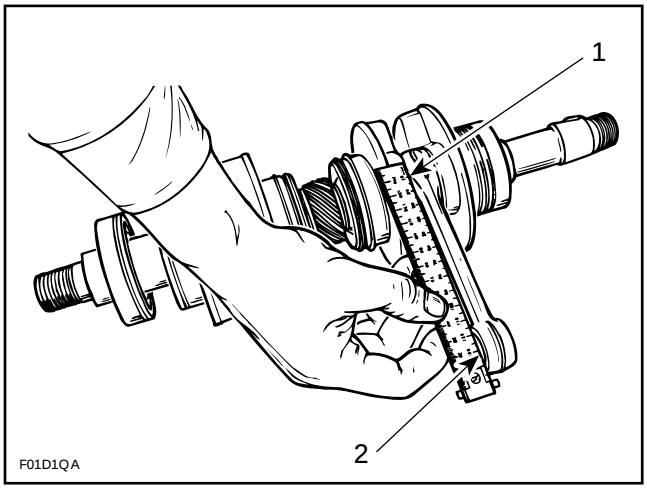
MEASUREMENT	NEW PARTS (min.)	NEW PARTS (max.)	WEAR LIMIT
Connecting rod big end axial play	0.390 mm (.015 in)	.737 mm (.029 in)	1.2 mm (.047 in)

MEASUREMENT	MAG SIDE	PDM SIDE
Crankshaft deflection (max.)	0.050 mm (.002 in)	0.030 mm (.001 in)

Connecting Rod Straightness

Align a steel ruler on edge of small end connecting rod bore. Check if ruler is perfectly aligned with edge of big end.

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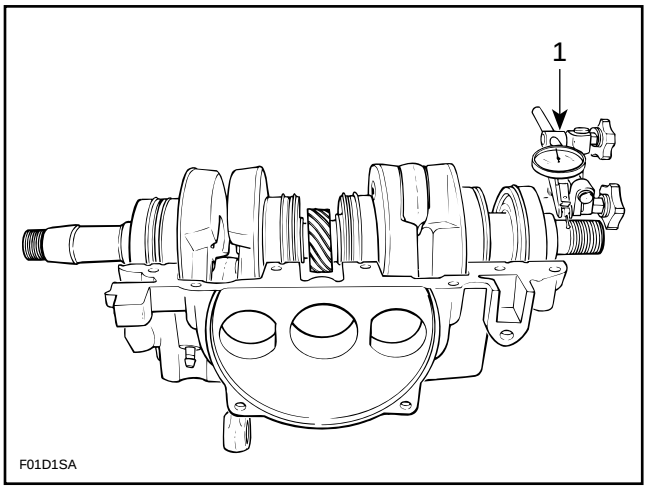


1. Ruler must be aligned with edge of connecting rod here
2. Align ruler here

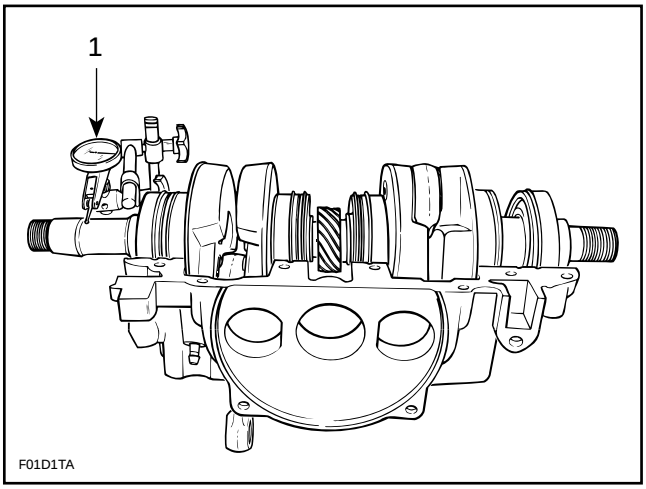
Crankshaft Deflection

Crankshaft deflection is measured each end with a dial indicator.

First, check deflection with crankshaft in crankcase. If deflection exceeds the specified tolerance, it can be either ball bearings wear, bent or twisted crankshaft at connecting rod journal.

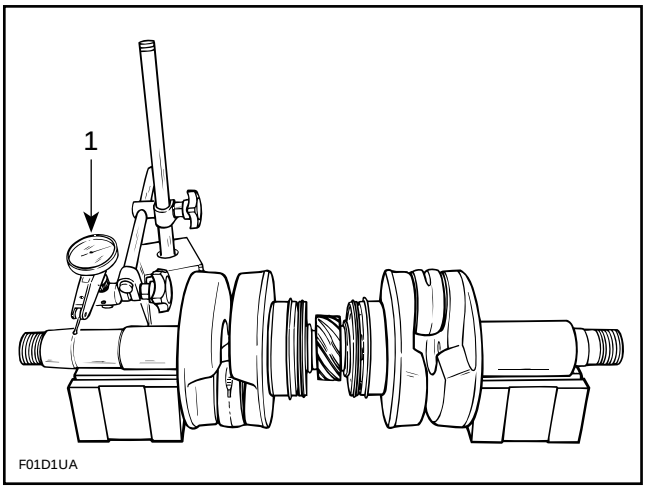


1. Measuring PTO side deflection in crankcase

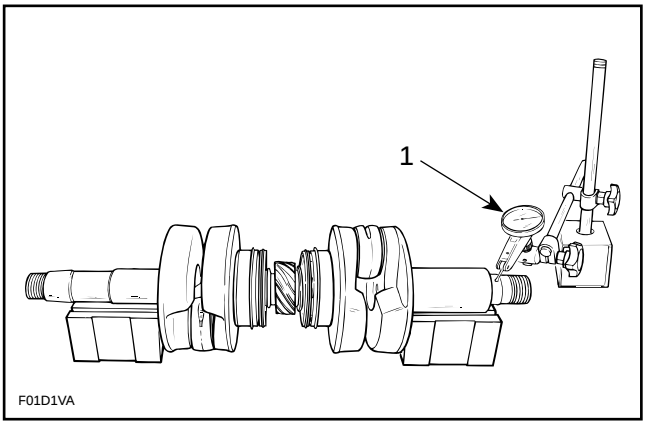


1. Measuring MAG side deflection in crankcase

Remove crankshaft bearings and check deflection again on V-shaped blocks as illustrated.



1. Measuring MAG side deflection on V-shaped blocks



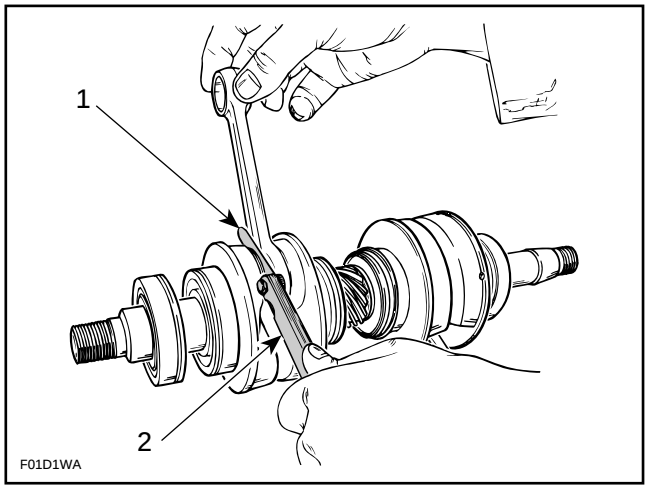
1. Measuring PTO side deflection on V-shaped blocks

NOTE : Crankshaft deflection can not be correctly measured between centers of a lathe.

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Connecting Rod Big End Axial Play

Using a feeler gauge, measure distance between thrust washer and crankshaft counterweight.



1. Measuring big end axial play
2. Feeler gauge

ASSEMBLY

Assembly is essentially the reverse of disassembly procedures. However pay particular attention to the following.

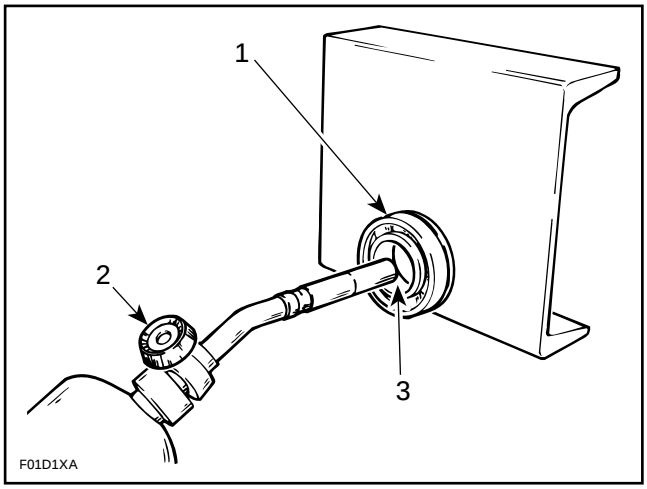
2,4,5,14, Bearing and Crankshaft

Apply Loctite 767 Anti-seize on part of crankshaft where bearing fits.

Prior to installation, place bearings into a container filled with oil, previously heated to 75°C (167°F). This will expand bearing and ease installation.

Or, as an alternate method, apply heat with a propane torch. Lay bearing on a steel plate, then heat plate through bearing bore until smoke is noticed from bearing. Install bearing carefully on crankshaft.

▼ CAUTION : Immediately stop heating as soon as smoke is noticed. Overheating bearing will melt plastic cage. Practice with used bearings on first try.

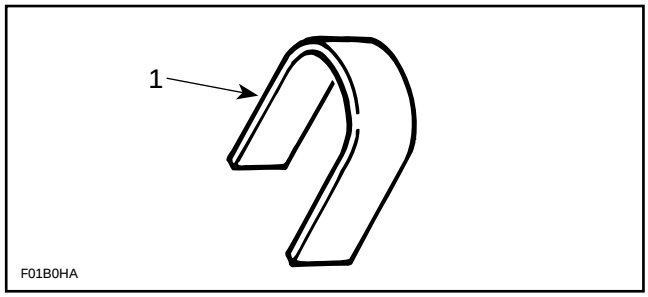


1. Bearing against a steel plate
2. Propane torch
3. Heat plate through bearing bore

5, Outer PTO Bearing

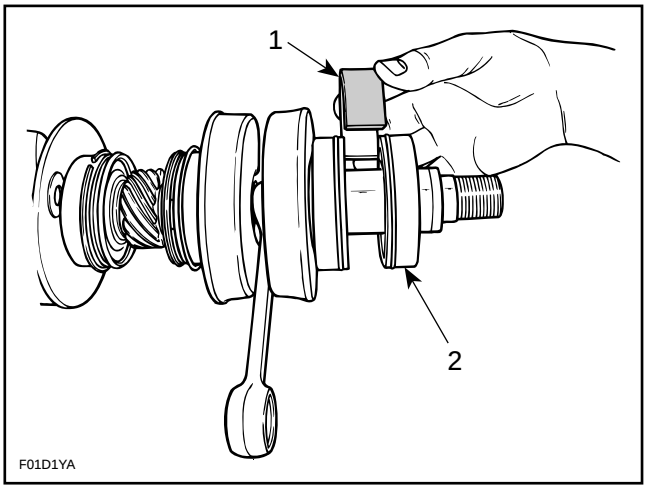
To properly position the outer PTO bearing, a distance gauge must be temporarily installed against the inner bearing. Slide the outer bearing until stopped by the distance gauge, then remove it.

ENGINE	DISTANCE GAUGE
587	P/N 290 876 826
717	P/N 290 876 827
787	P/N 290 876 828



1. Distance gauge

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TYPICAL

1. *Distance gauge*
2. *PTO side outer bearing*

15, Distance Ring

When installing the distance ring on the magneto side, make sure to position it with its chamfer toward the counterweight of the crankshaft.

1, Seal

At seal assembly, apply a light coat of lithium grease on seal lips.

6, Drive Pin

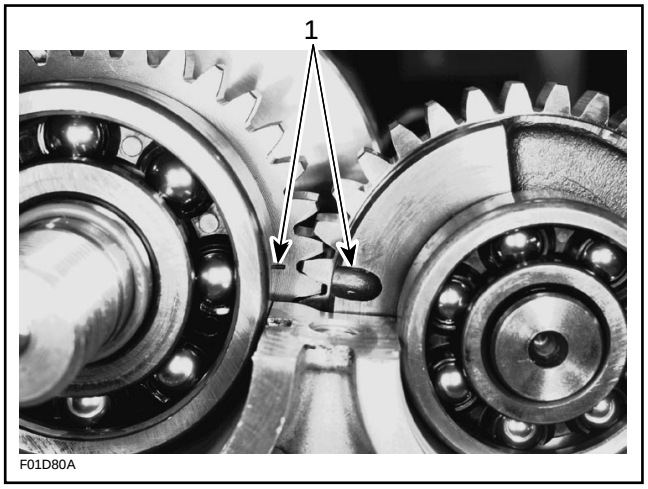
Make sure drive pins of bearings (where applicable) are properly installed in crankcase recesses at assembly.

13,14, Counterbalance Shaft and Crankshaft

787 Engine

Install crankshaft first in crankcase.

After crankshaft installation, install counterbalance shaft. Make sure to properly index crankshaft and counterbalance shaft by aligning marks of gears.



1. *Marks*

3, Crankcase

Crankcase halves are factory matched and therefore, are not interchangeable or available as single halves.

Prior to joining crankcase halves, apply a light coat of Loctite 515 on mating surfaces. Do not apply in excess as it will spread out inside crankcase.

NOTE : On aluminum material it is recommended to use Loctite Primer N to reduce curing time and increase gap filling capability. Refer to manufacturer's instructions.

CAUTION : Rotary valve shaft must be installed in crankcase before closing halves. Before joining crankcase halves, make sure that crankshaft gear is well engaged with rotary valve shaft gear.

Position crankcase halves together and hand-tighten screws.

CAUTION : Temporarily install armature plate to align crankcase halves with each other (except the 787 engine).

11, Fitting

If inlet and outlet oil fittings of rotary valve shaft have been removed from crankcase, reinstall them with their ends pointing toward ignition housing. Apply Loctite 515 on threads of fittings.

7,8, Crankcase Screw

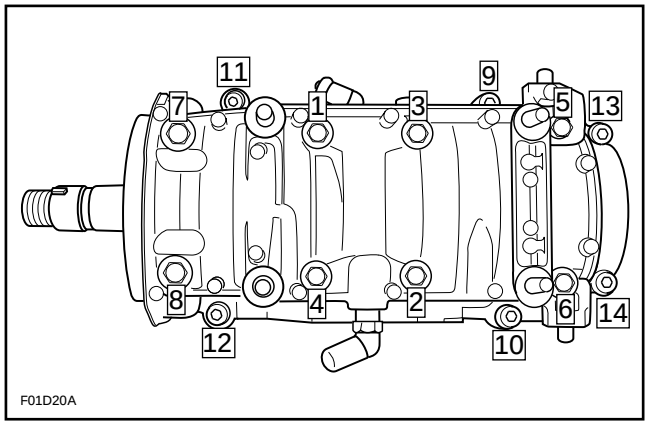
Apply Loctite 515 on screw threads and synthetic grease below head screws.

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587 and 717 Engines

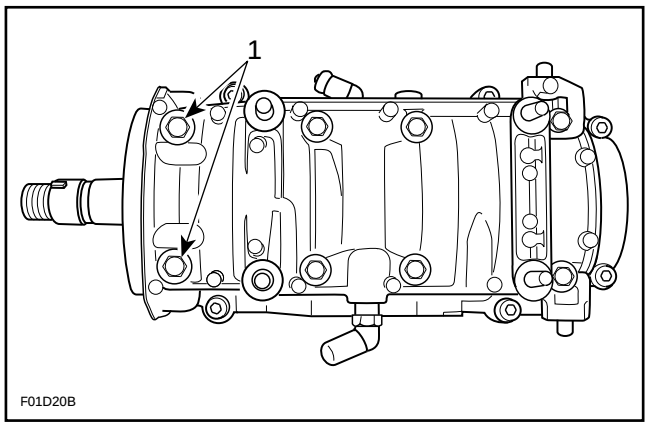
7,8,9, Crankcase Screw

Torque crankcase screws to 24 N•m (17 lbf•ft) as per following illustrated sequence.



8, Crankcase Screw

Torque 2 M10 crankcase screws to 40 N•m (30 lbf•ft).



1. Torque to 40 N•m (30 lbf•ft)

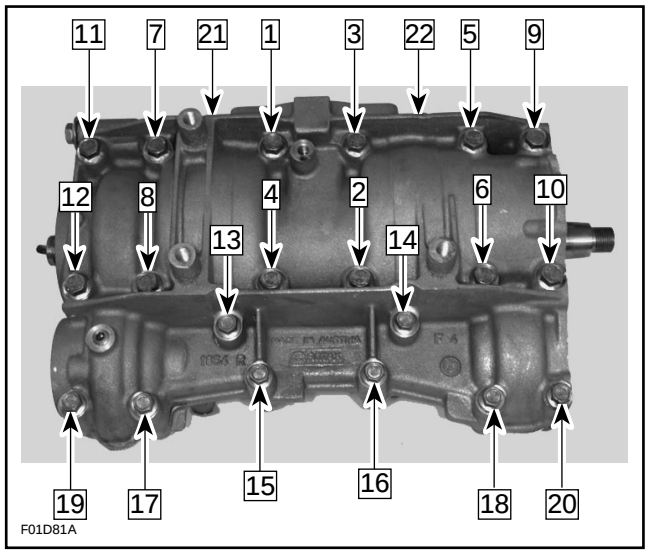
10, Stud

At assembly in crankcase, apply Loctite 515 on stud threads. Torque to 10 N•m (88 lbf•in).

787 Engine

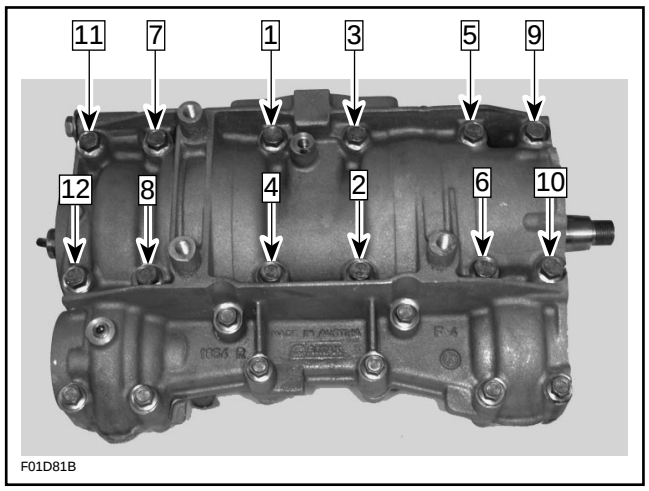
7,8, Crankcase Screw

Torque crankcase screws to 12 N•m (9 lbf•ft) as per following sequence. Repeat procedure, re-tightening all screws to 24 N•m (17 lbf•ft).



8, Crankcase Screw

As a final step, torque only M10 screws of crankcase to 40 N•m (30 lbf•ft) as per following sequence.



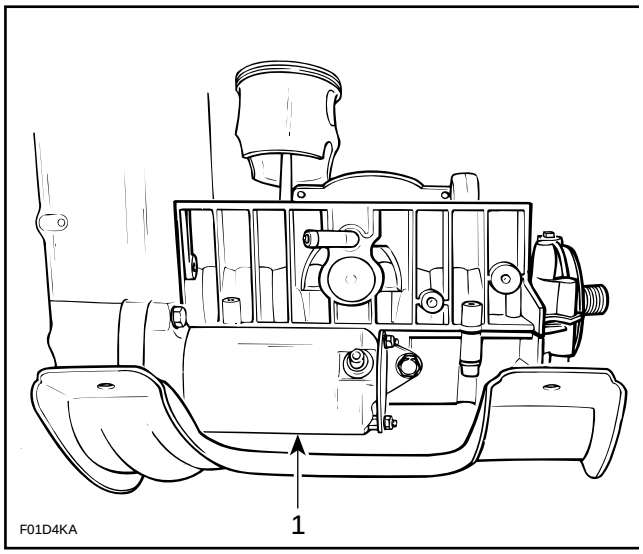
Final Assembly

For rotary valve timing and assembly procedures, refer to ENGINE 04-04.

587 and 717 Engines

If engine support is installed on crankcase before ignition housing, electric starter must be installed before engine support.

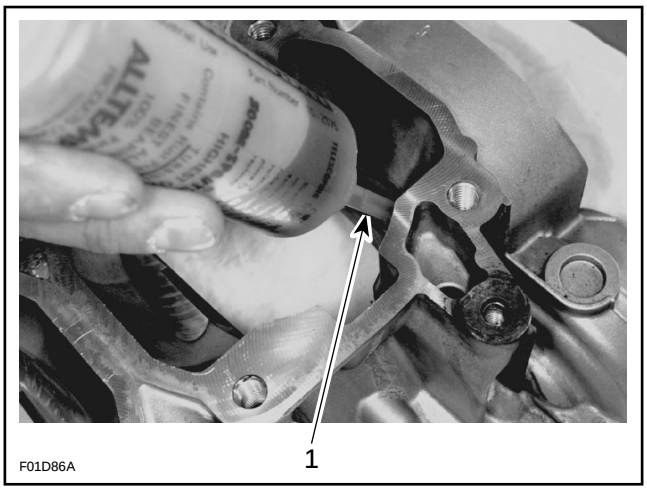
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1. Install starter before engine support

787 Engine

Add 30 mL (1 oz) of FORMULA XP-S synthetic injection oil in the small hole near the transfer of the PTO cylinder.

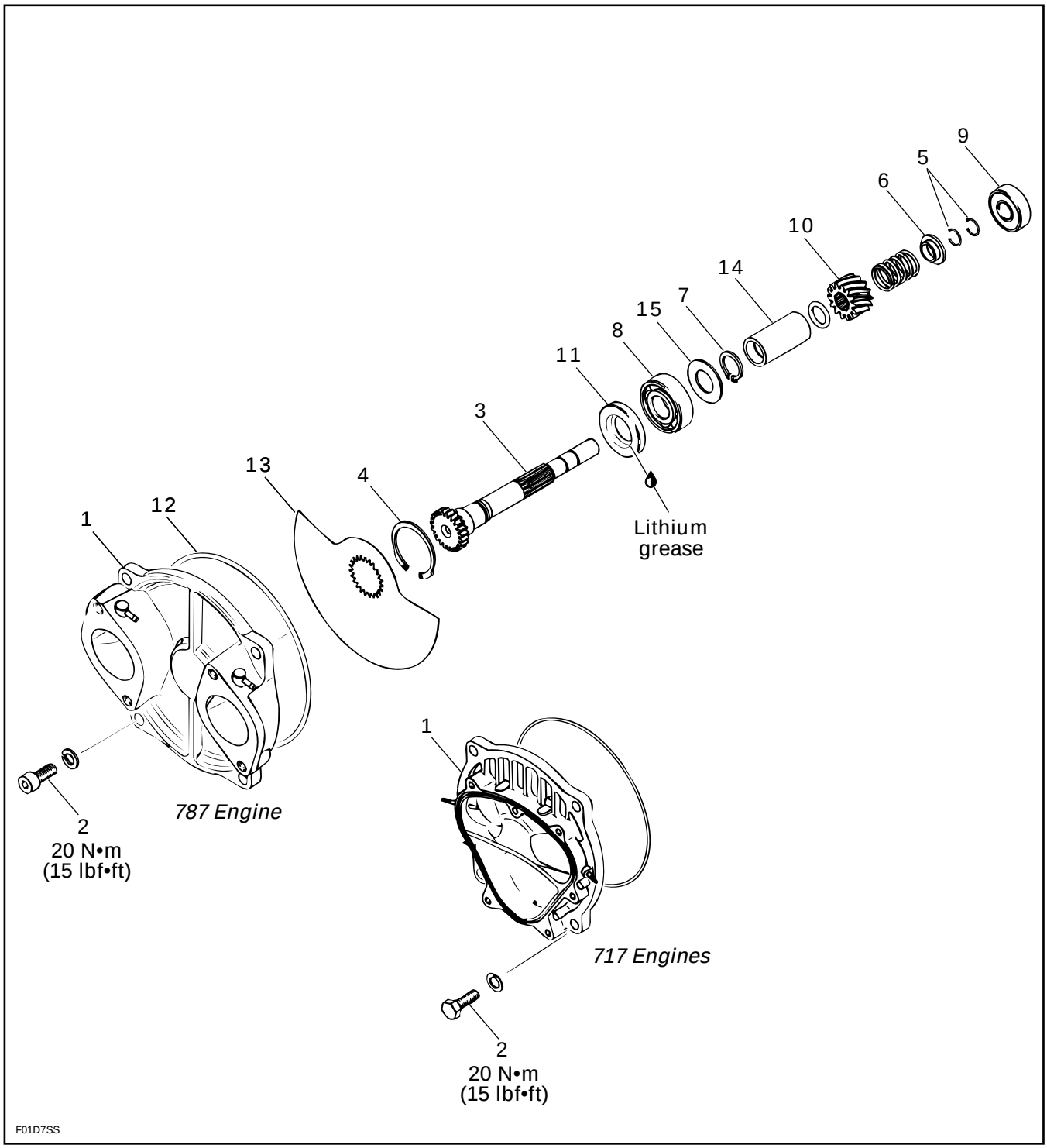


TYPICAL

1. Add 30 mL (1 oz) of injection oil

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ROTARY VALVE



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GENERAL

The following verification procedures such as clearance of rotary valve cover or rotary valve shaft gear backlash can be performed without removing engine from watercraft.

However engine must be removed from watercraft to work on rotary valve shaft / components. Refer to ENGINE 04-01 for engine removal procedure.

Bottom end must be opened to remove rotary valve shaft. Refer to ENGINE 04-03.

INSPECTION ON WATERCRAFT

Remove carburetor(s). Refer to FUEL SYSTEM 06-03.

NOTE : On the 587 engine, rotary valve cover and carburetor are removed as an assembly.

1,2, Rotary Valve Cover and Screw

Unscrew 4 retaining screws and withdraw rotary valve cover and valve.

Rotary Valve / Cover Clearance

The clearance between the rotary valve and the cover must be 0.30 ± 0.05 mm (.012 ± .002 in).

NOTE : If the clearance is below 0.25 mm (.010 in) this could create an overheating situation and if the clearance is over 0.35 mm (.014 in) this could create a hard starting situation.

There is two methods to verify rotary valve / cover clearance. One with a 45° feeler gauge, the other one with a solder.

45° FEELER GAUGE METHOD

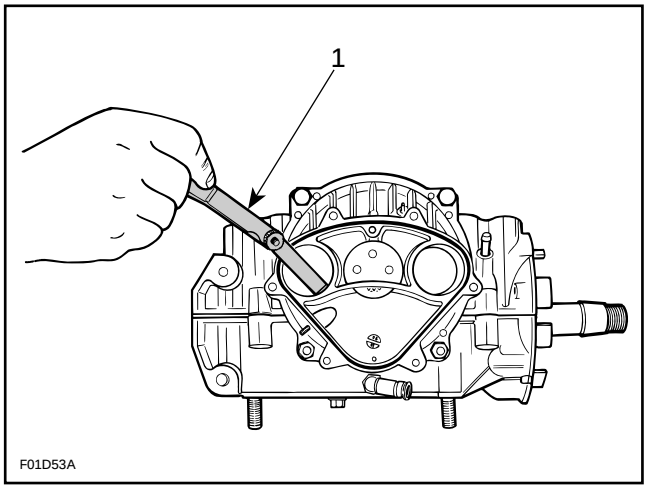
Remove O-ring from rotary valve cover.

Remove intake manifold from rotary valve cover (except 787 engine).

Reinstall cover in place WITHOUT its O-ring and torque screws to 20 N•m (15 lbf•ft).

Feeler gauge blade from 0.25 mm (.010 in) to 0.35 mm (.014 in) thickness should fit between rotary valve and cover.

Insert feeler gauge blade through cover inlet ports to verify clearance. At least verify clearance at two different places in each port.



1. 45° feeler gauge

SOLDER METHOD

Remove O-ring from rotary valve cover.

Use the following type of solder :

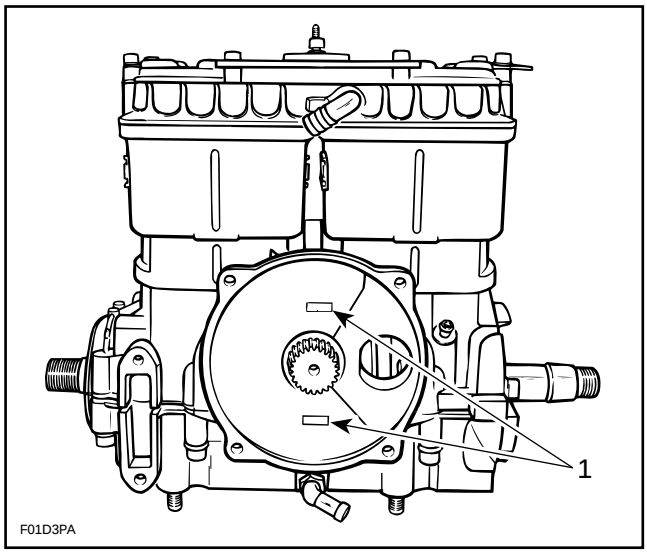
- rosin core
- diameter : 0.8 mm (.032 in)
- electronic application (available at electronic stores)

Install two short pieces (13 mm (1/2 in) long) of solder directly on rotary valve, one above and one below rotary valve gear. Apply grease to hold solder in position.

Reinstall cover in place WITHOUT its O-ring and torque screws to 20 N•m (15 lbf•ft).

Remove cover then clean and measure compressed solder thickness, it must be within the specified tolerance 0.30 ± 0.05 mm (.012 ± .002 in).

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TYPICAL

1. Solder

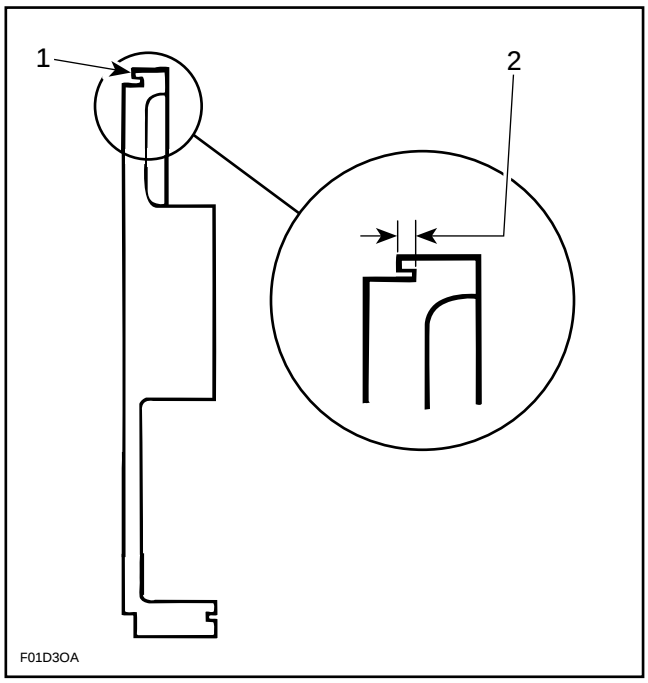
If rotary valve cover clearance is out of specification, machine rotary valve cover seating surface or replace the cover.

MACHINING INFORMATION

The amount of material over tolerance must be removed from the rotary valve cover seating surface.

Also cut the O-ring groove the same amount to keep the 1.0 ± 0.03 mm (.039 ± .001 in) depth between the bottom of the groove and the seating surface.

Remove burrs on the edges of the seating surface and O-ring groove.



SAME AMOUNT REMOVED FROM COVER SEATING SURFACE AND O-RING GROOVE BASE

1. Cover seating surface
2. O-ring groove depth must be 1.0 ± 0.03 mm (.039 ± .001 in)

Reverify the clearance.

At assembly the rotary valve timing must remain as per original setting.

NOTE : If rotary valve crankcase surface is worn, it is possible to have it rework at the factory. Contact your dealer or distributor.

Rotary Valve Shaft Gear Backlash

Remove PTO flywheel guard.

Remove spark plugs, rotary valve cover and valve.

Manually feel backlash at one position, then turn crankshaft about 1/8 turn and recheck. Continue this way to complete one revolution.

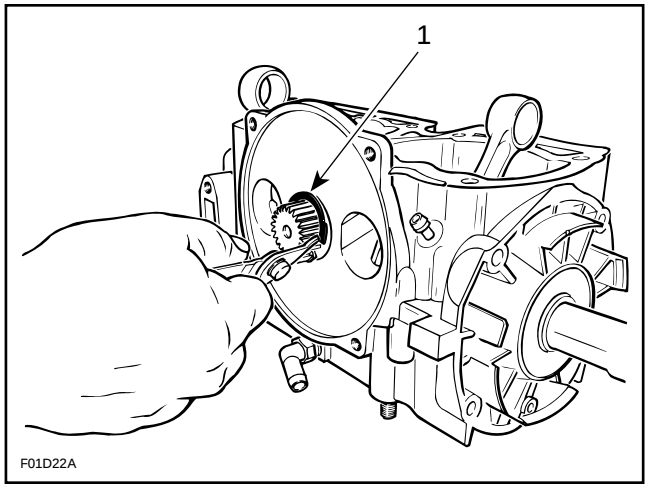
Backlash must be even at all positions. Otherwise overhaul engine to find which part is faulty (gear, rotary valve shaft or crankshaft with excessive deflection).

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DISASSEMBLY

3,4, Rotary Valve Shaft and Snap Ring

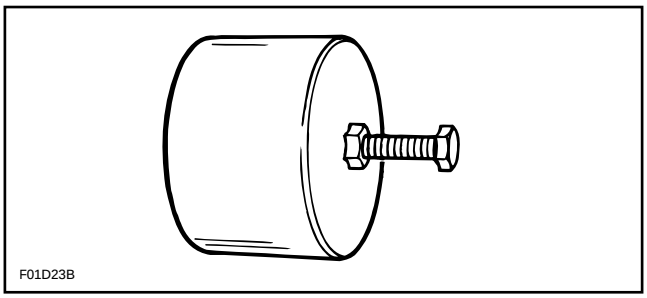
To remove rotary valve shaft assembly, first remove snap ring from crankcase.



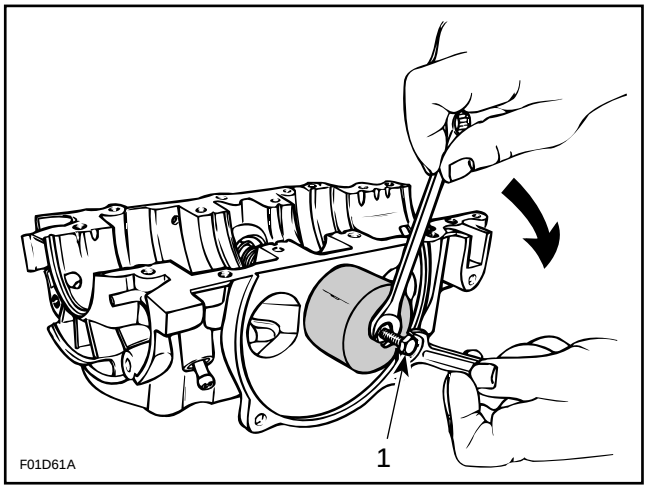
1. Removing snap ring

▼ CAUTION : Bottom end must be opened to remove rotary valve shaft.

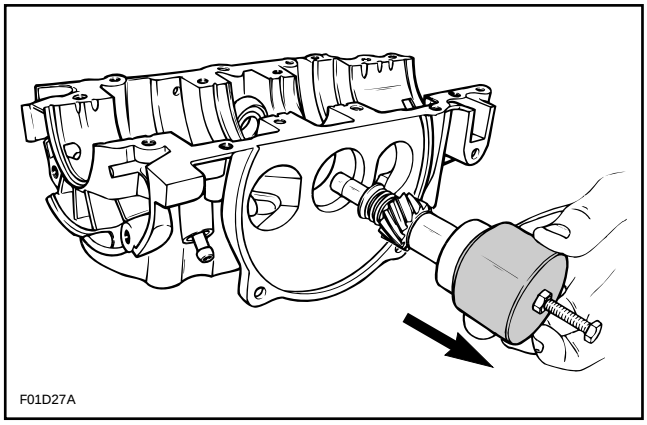
To remove rotary valve shaft, use puller (P / N 290 876 487) for the 587 and 717 engines or puller (P / N 290 876 488) for the 787 engine.



Place puller over rotary valve shaft end and screw on puller bolt into shaft. While retaining bolt with a wrench, turn puller nut CLOCKWISE until shaft comes out.

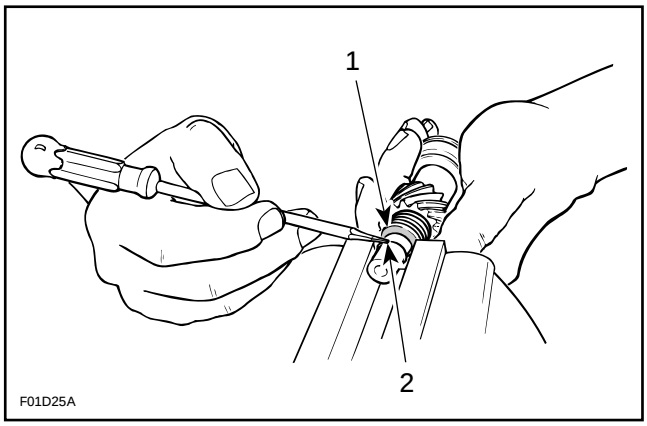


1. Hold bolt



5,6, Circlip and Spring Seat

If it is necessary to disassemble components of rotary valve shaft assembly, use seat to compress spring and remove circlips.

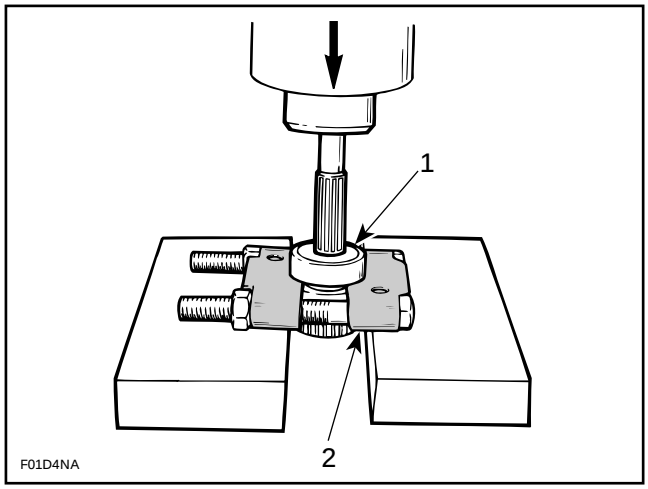


1. Compress seat
2. Remove circlips

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7,8, Snap Ring and Bearing

To remove bearing use a bearing extractor such as Snap-on no CJ-950 as illustrated. Slide off distance sleeve, remove snap ring and press shaft out.

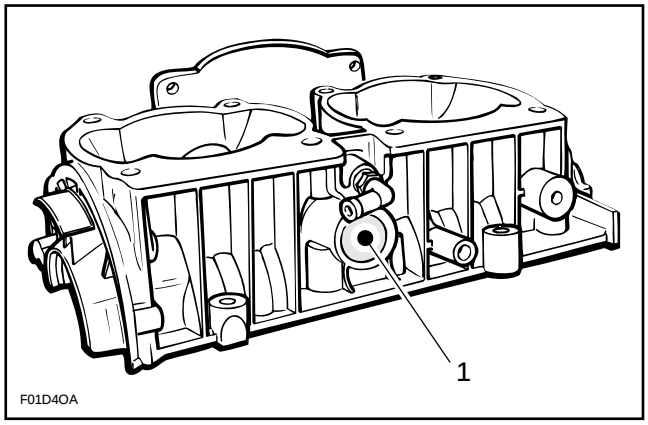


1. Bearing
2. Bearing extractor Snap-on CJ-950

▼CAUTION : Ensure that rotary valve shaft is perfectly perpendicular with press tip or damage will occur.

9, Bearing

▼CAUTION : Do not remove plug against bearing in upper crankcase half.

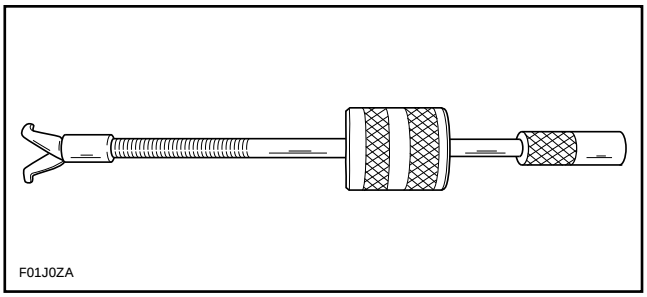


1. Do not remove this plug

End bearing can be easily removed using the following suggested tool.

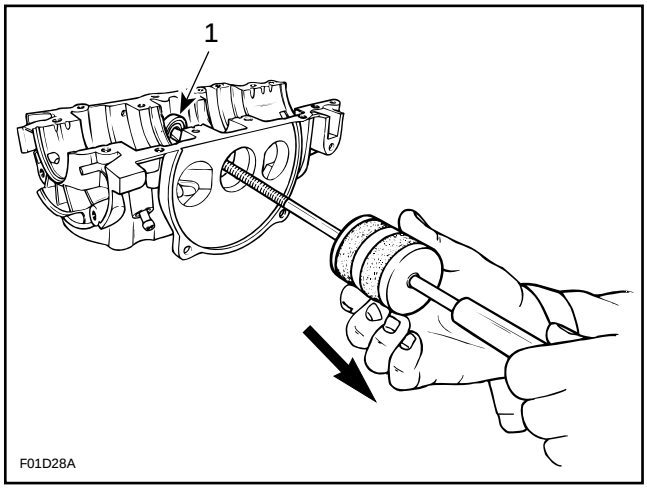
Snap-on hammer puller including :

Handle	CJ93-1
Hammer	CJ125-6
Claws	CJ93-4



Close puller claws so that they can be inserted in end bearing. Holding claws, turn puller shaft clockwise so that claws open and become firmly tight against bearing.

Slide puller sleeve outwards and tap puller end. Retighten claws as necessary to always maintain them tight against bearing. Continue this way until bearing completely comes out.



1. End bearing

CLEANING

Discard all seals and O-rings.

Clean all metal components in a solvent.

Clean oil passages and make sure they are not clogged.

Clean rotary valve shaft and inside of distance sleeve.

INSPECTION

1, Rotary Valve Cover

Inspect rotary valve cover for warpage. Small deformation can be corrected by surfacing with fine sand paper on a surface plate. Surface part against oiled sand- paper.

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8,9 Bearing

Inspect bearings. Check for scoring, pitting, chipping or other evidence of wear. Make sure plastic cage (on bigger bearing) is not melted. Rotate them and make sure they turn smoothly.

10, Gear

Visually check gear wear pattern. It should be even on tooth length all around. Otherwise it could indicate a bent shaft, check deflection. Replace gear if damaged.

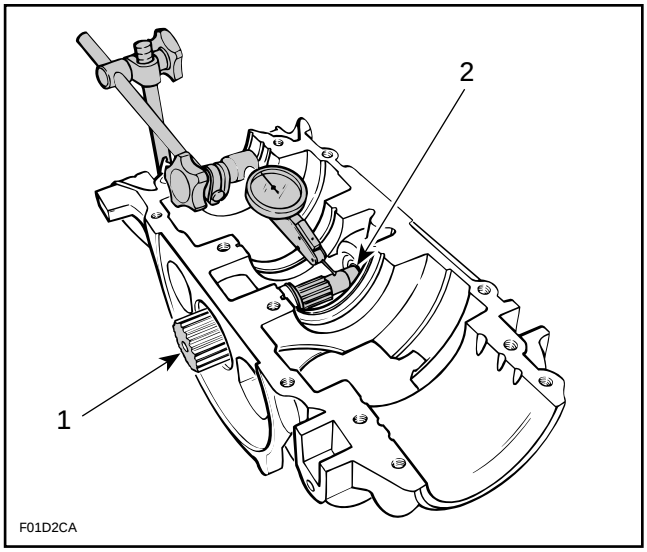
Check for presence of brass filings in gear housing.

Rotary Valve Shaft Deflection

Deflection is measured with a dial gauge. Install rotary valve shaft in crankcase half, without its gear.

NOTE : End bearing must be in crankcase half.

Measure shaft deflection near gear mounting area.



1. Rotary valve shaft
2. End bearing in place

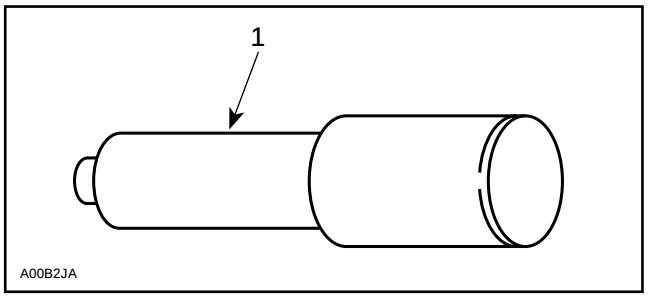
Deflection must not exceed specified value. Replace shaft as necessary.

ASSEMBLY

Assembly is essentially the reverse of disassembly procedures. However pay particular attention to the following.

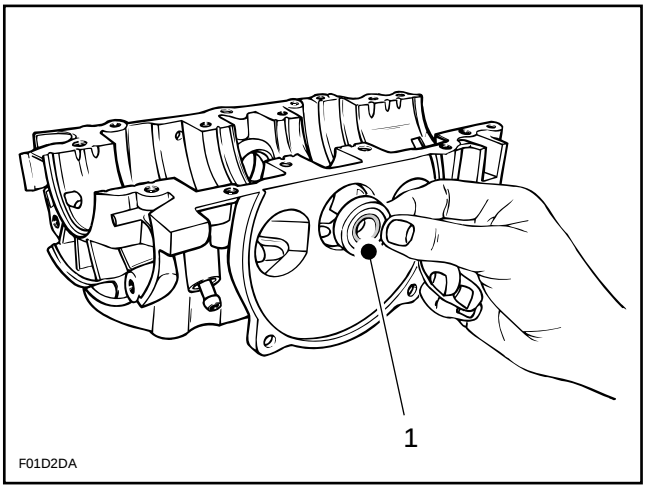
9, Bearing

To install end bearing in crankcase, use a pusher (P / N 290 876 500).



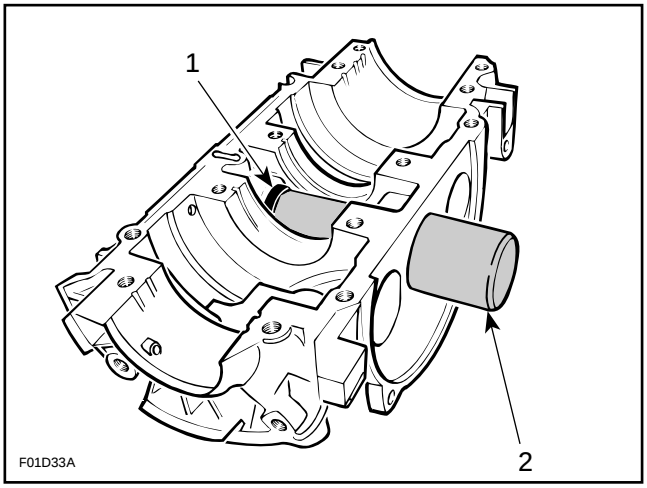
1. Pusher

Position ball bearing shielded side towards rotary valve.



1. Shield side (toward gear)

Push bearing until it stops on its seat.



1. Bearing
2. Pusher

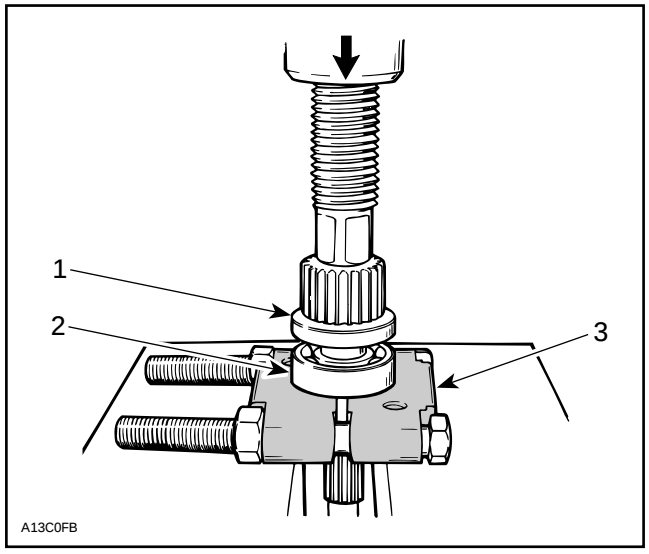
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3,11, Rotary Valve Shaft and Seal

Apply lithium grease on seal lips. Position seal with shielded portion against shaft splines.

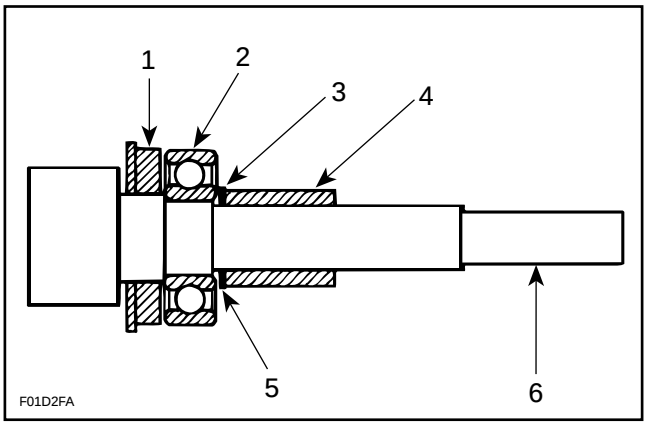
3,7,8, Rotary Valve Shaft, Snap Ring and Bearing

Install ball bearing as illustrated.



1. *Seal*
2. *Ball bearing*
3. *Bearing extractor Snap-on CJ-950*

Install shim, snap ring and slide distance sleeve on shaft.



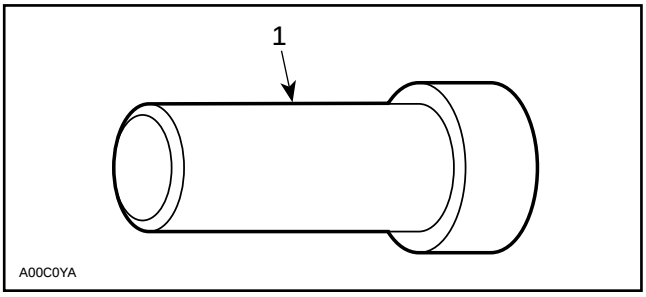
1. *Seal*
2. *Ball bearing*
3. *Snap ring*
4. *.Distance sleeve*
5. *Shim 0.5 mm (.020 in)*
6. *Rotary valve shaft*

3,4, Rotary Valve Shaft Ass'y and Snap Ring

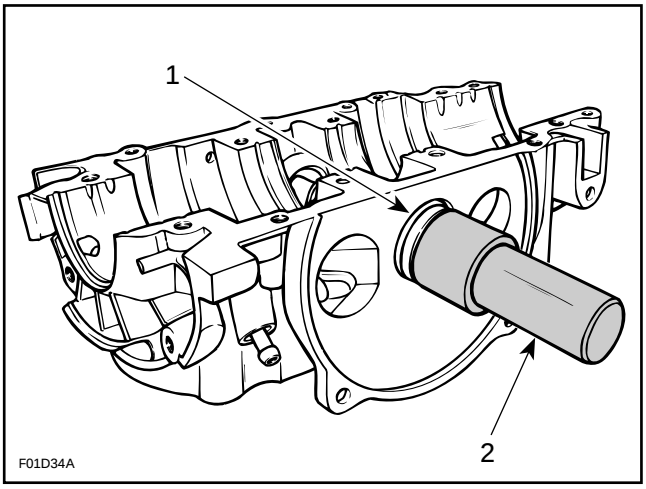
▼CAUTION : Crankcase halves must be separated and crankshaft must not be present to install rotary valve shaft ass'y in crankcase.

587 and 717 Engines

To install rotary valve shaft in crankcase, use a pusher (P / N 290 876 605).



Push shaft until its stops on bearing seat.

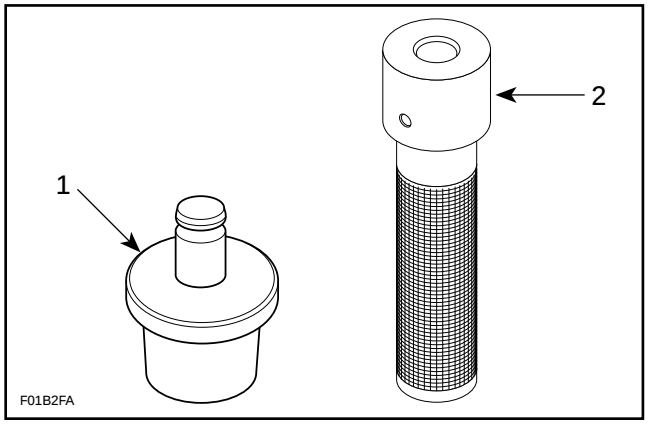


1. *Rotary valve shaft ass'y*
2. *Push shaft until it stops*

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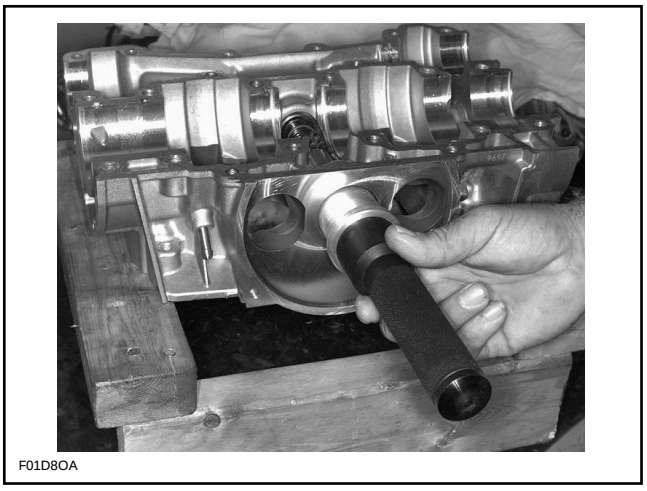
787 Engine

To install rotary valve shaft in crankcase, use a pusher (P / N 290 876 609) and handle (P / N 290 877 650).



1. Pusher
2. Handle

Push shaft until it stops on bearing seat.



All Engines

At snap ring installation, position it so that its sharp edge faces outwards.

13, Rotary Valve

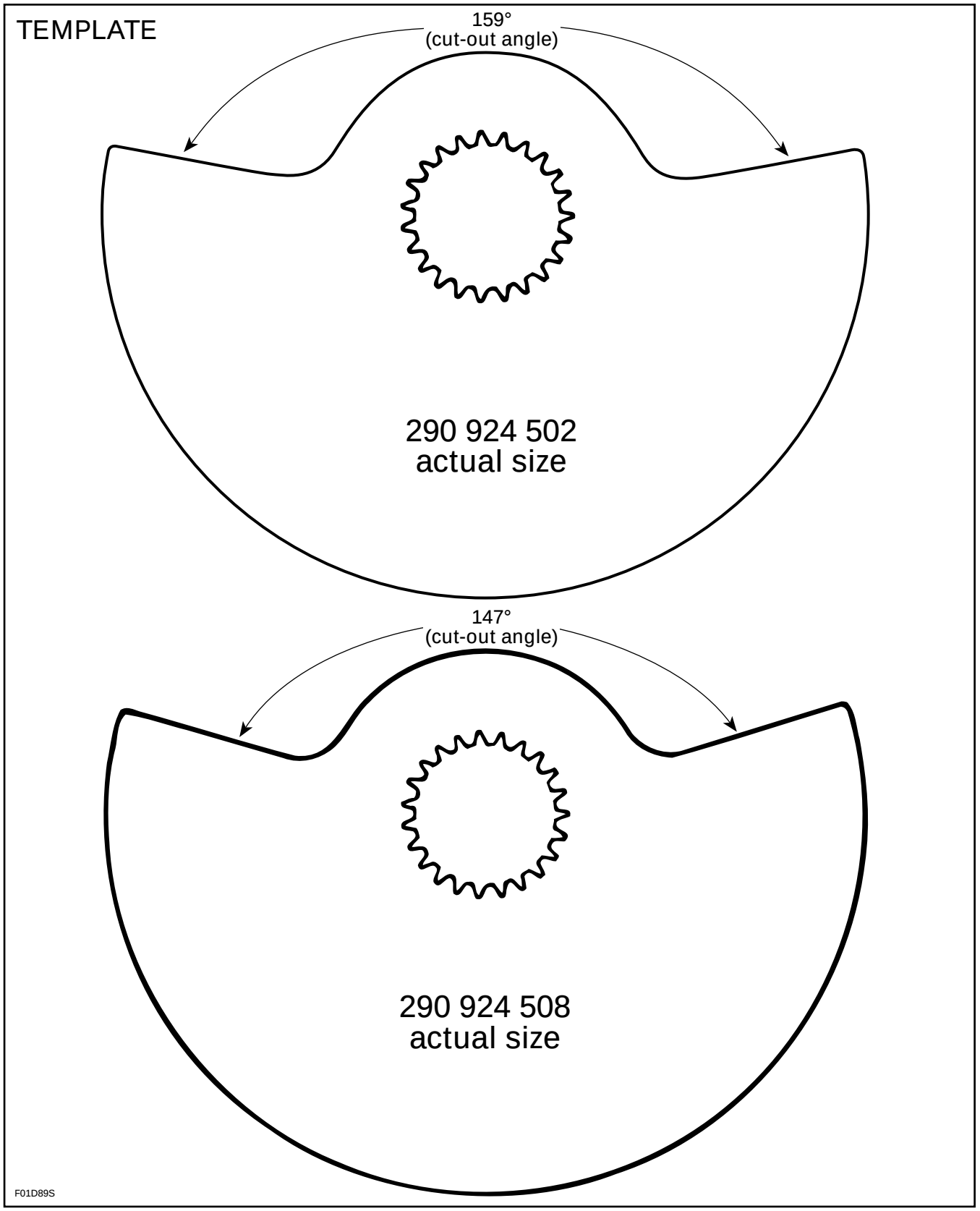
The rotary valve controls the opening and closing of the inlet ports. Therefore its efficiency will depend on the precision of its installation.

IDENTIFICATION OF THE ROTARY VALVE

Engine	Rotary Valve P/N	Valve Duration
587	290 924 508	147°
717 and 787	290 924 502	159°

There is no identification code on the valves. To find out the duration, place an angle finder on the valve and measure the valve cut-out angle or use the following templates.

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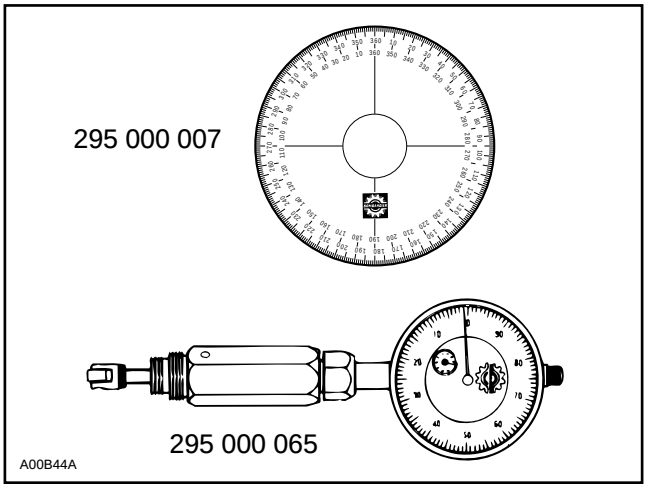


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ROTARY VALVE TIMING

CAUTION : Never use the ridge molded in crankcase as a timing mark.

The following tools are required to measure rotary valve opening and closing angles in relation with MAG side piston.



Rotary valve must be set so that timing occurs as follows :

ENGINE	TIMING	
	OPENING BTDC	CLOSING ATDC
587	130° ± 5	65° ± 5
717	147° ± 5	65° ± 5
787	146.5° ± 5	64° ± 5

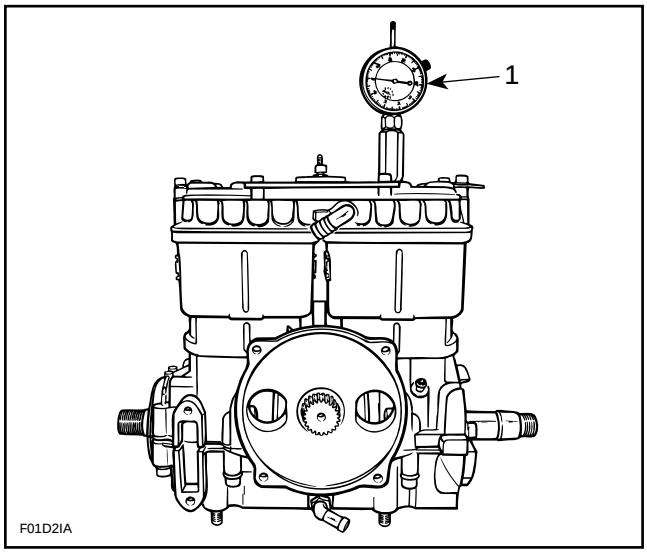
For the following instructions, let's use these specifications as example :

OPENING : 130° BTDC

CLOSING : 65° ATDC

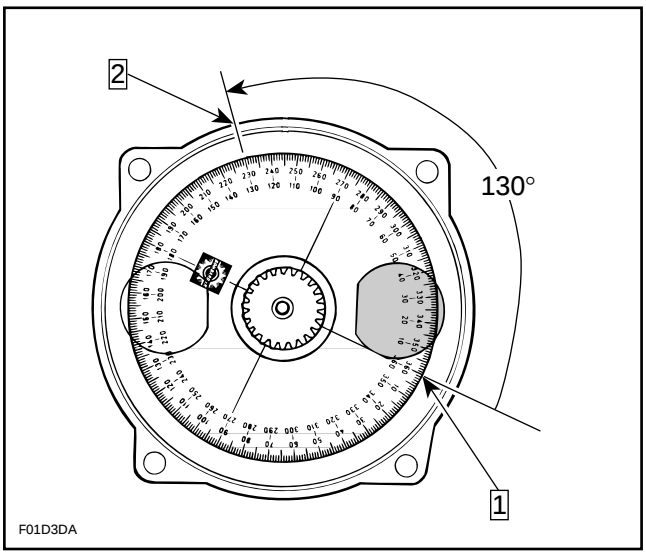
Proceed as follows :

– Turning crankshaft, bring MAG side piston to Top Dead Center using a TDC gauge.



1. Bring piston to TDC

– For opening mark, first align 360° line of degree wheel with BOTTOM of MAG side inlet port. Then, find 130° line on degree wheel and mark crankcase at this point.

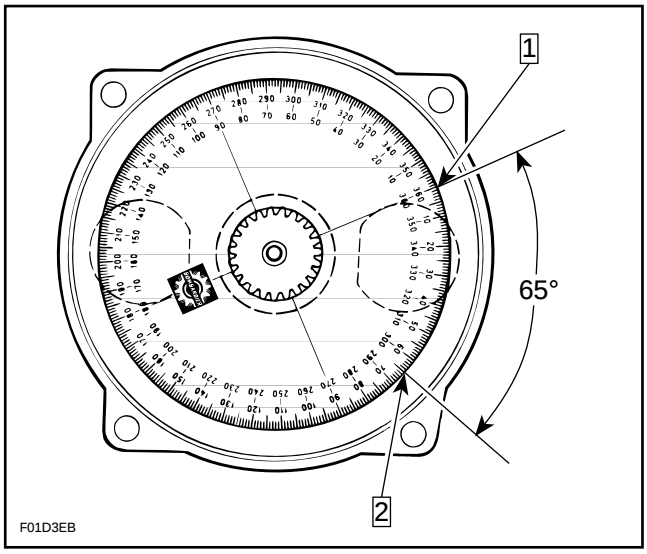


OPENING MARK
Step [1] : Bottom of MAG inlet port. Align 360° line of degree wheel
Step [2] : Find 130° on degree wheel and mark here

NOTE : Do not rotate the crankshaft.

– For closing mark, first align 360° line of degree wheel with TOP of MAG side inlet port. Then, find 65° line on degree wheel and mark crankcase at this point.

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CLOSING MARK
Step 1 : Top of MAG inlet port.
Align 360° line of degree wheel
Step 2 : Find 65° on degree wheel and mark here

– Remove degree wheel.
– Position rotary valve on shaft splines to have edges as close as possible to these marks with the MAG piston at TDC.

NOTE : Rotary valve is asymmetrical. Therefore, try flipping it over then reinstall on splines to obtain best installation position.

Apply BOMBARDIER-ROTAX injection oil on rotary valve before reassembling rotary valve cover.

– Remove TDC gauge.

1,2,12, Rotary Valve Cover, Screw and O-ring

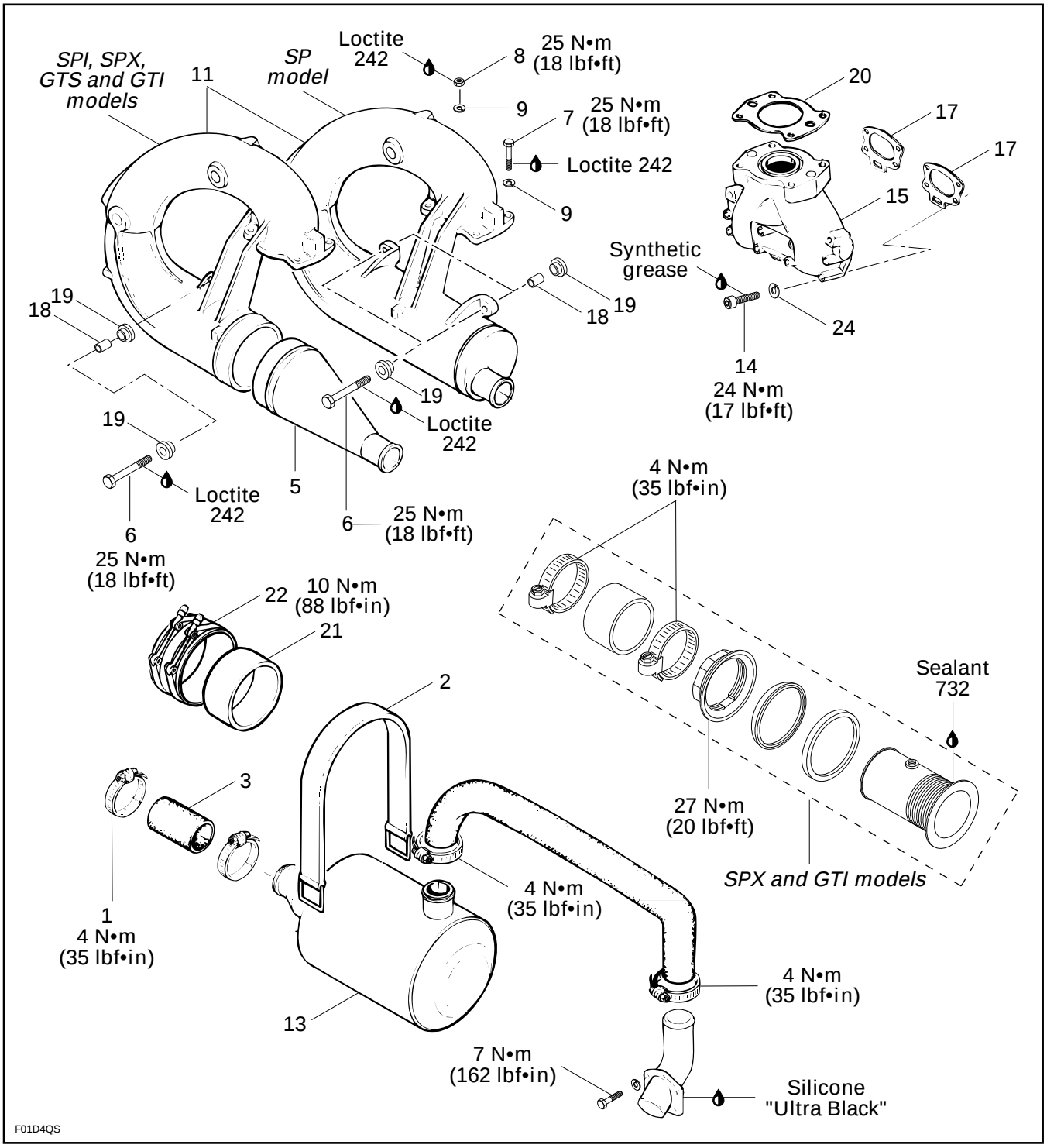
Install O-ring and cover then torque screws to 20 N•m (15 lbf•ft) in a criss-cross sequence.

NOTE : For the 587 engine, install engine in watercraft first ; then, install rotary valve cover, intake manifold and carburetor as an assembly.

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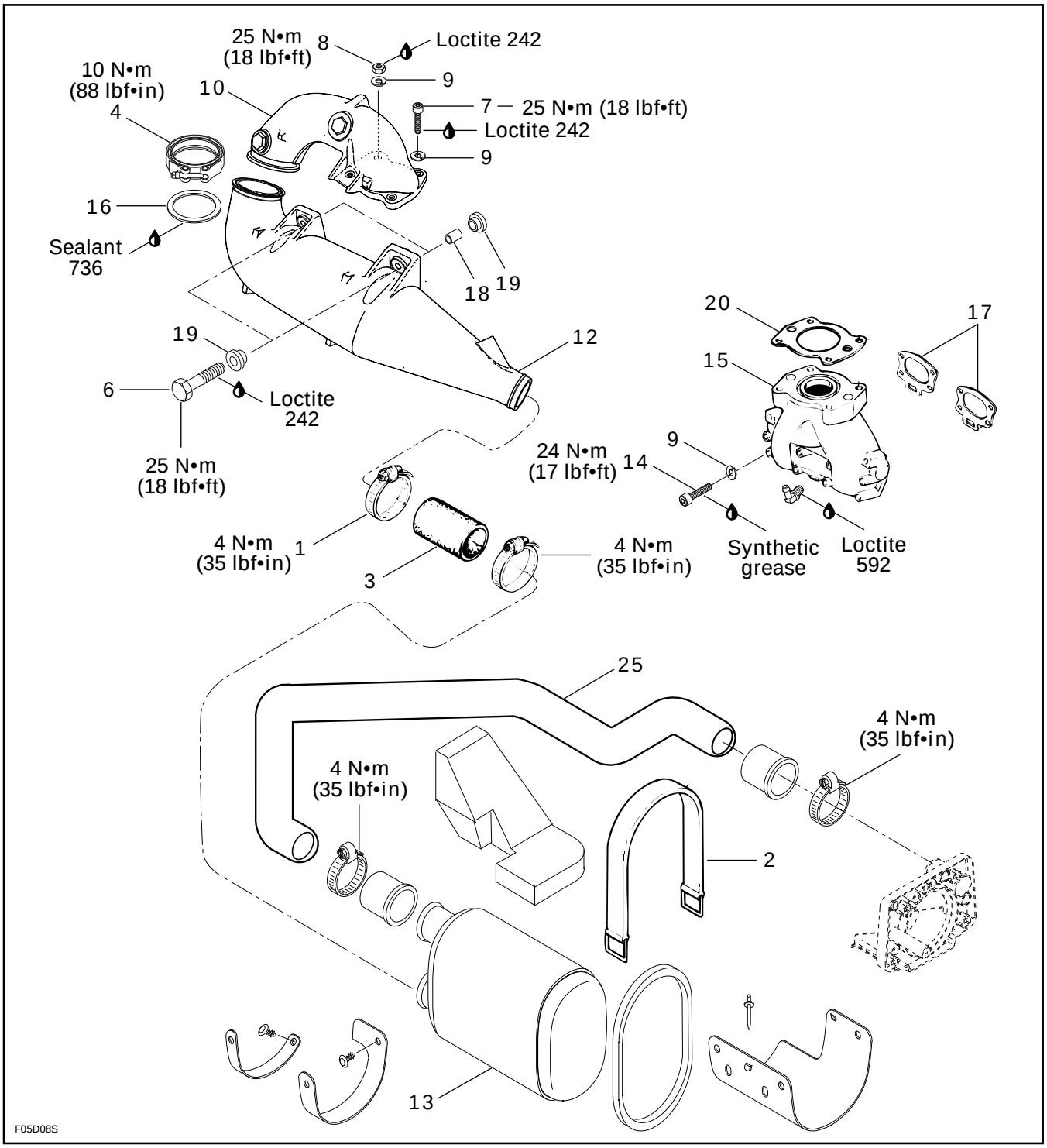
EXHAUST SYSTEM

SP Series, GTS and GTI Models



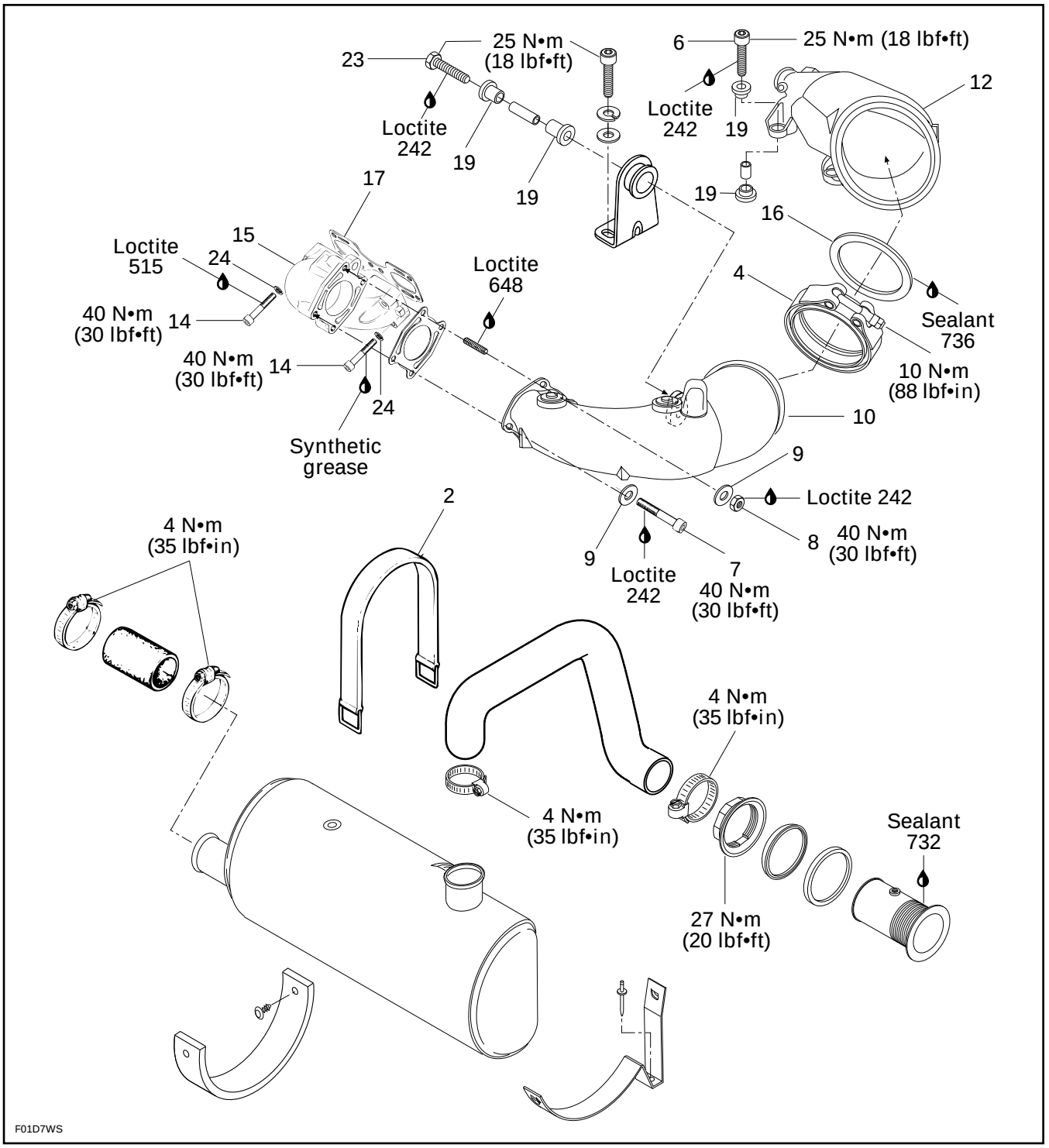
PARTS
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HX Model



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XP Model



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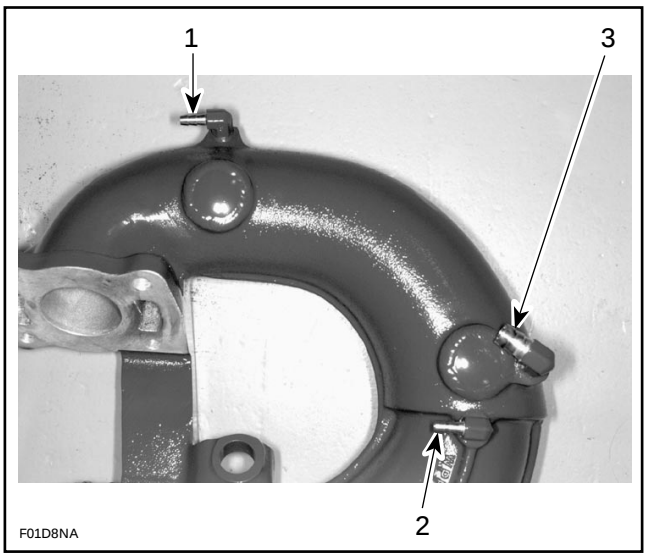
TUNED PIPE REMOVAL

All Models Except HX and XP

NOTE : For SP series, remove air vent tube support from body opening.

Disconnect water inlet hose and water injection hose.

Disconnect tuned pipe bleed hose.



TYPICAL

1. *Bleed hose removed*
2. *Injection hose removed*
3. *Inlet hose removed*

Cut tie rap retaining together engine and tuned pipe bleed hoses (if applicable).

1, Collar

Loosen exhaust hose collar at tuned pipe outlet.

2,13, Strap and Muffler

Disconnect strap retaining muffler.

3, Hose

Remove exhaust hose from tuned pipe by pulling muffler.

4,22, Clamp

Remove clamp from tuned pipe (except SP model).

5, Tuned Pipe Cone.

Remove tuned pipe cone (except SP model).

6, Screw

Remove tuned pipe retaining screw(s) from exhaust manifold side.

7,8,9, Screw, Nut and Flat Washer

Remove screws, nut and flat washers from tuned pipe flange.

NOTE : Slightly lift tuned pipe to release nut as necessary. Take care not drop nut and flat washer.

11, Tuned Pipe Head

Withdraw tuned pipe in a forward and rotating movement.

HX Model Only

NOTE : It is possible to remove the tuned pipe head and cone at the same time. If such is the case, disconnect only the water outlet hose at cylinder head and do not remove the clamp retaining tuned pipe head to tuned pipe cone.

Disconnect water inlet hose at tuned pipe head.

Disconnect water injection hose at tuned pipe cone.

Disconnect bleed hose on top of tuned pipe head.

4, Clamp

Remove clamp retaining tuned pipe head to tuned pipe cone (if desired).

7,8,9, Screw Nut and Flat Washer

Remove screws, nut and flat washers from tuned pipe head flange.

10, Tuned Pipe Head

Remove tuned pipe head.

1,3,6, Collar, Hose and Screw

Loosen exhaust hose collar at tuned pipe cone outlet.

Remove two screws retaining tuned pipe cone from exhaust manifold.

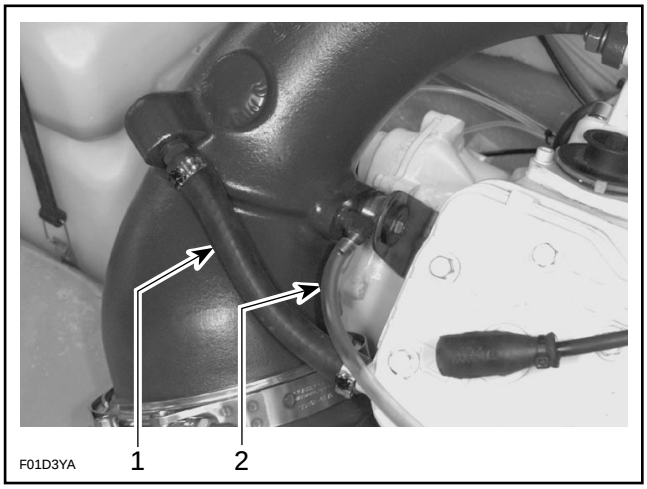
XP Model Only

Remove air vent tube support from body opening.

Remove electrical box from watercraft. Refer to ENGINE REMOVAL AND INSTALLATION 04-01.

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Disconnect water supply hose and water injection hose at tuned pipe head.



1. *Water supply hose*
2. *Water injection hose*

1,3, Collar and Hose

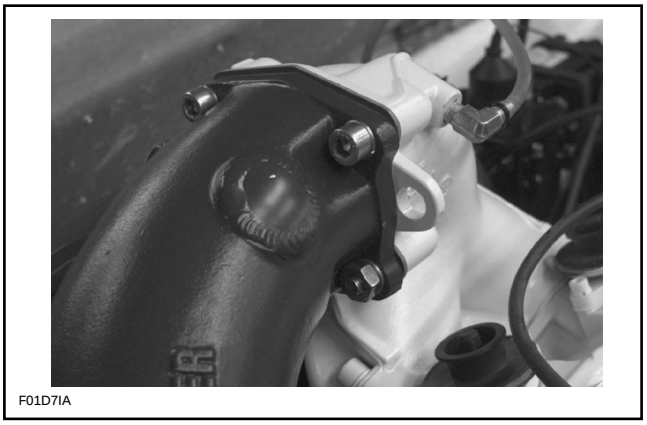
Loosen exhaust hose collar at tuned pipe cone outlet.

4, Clamp

Remove clamp securing tuned pipe cone to tuned pipe head.

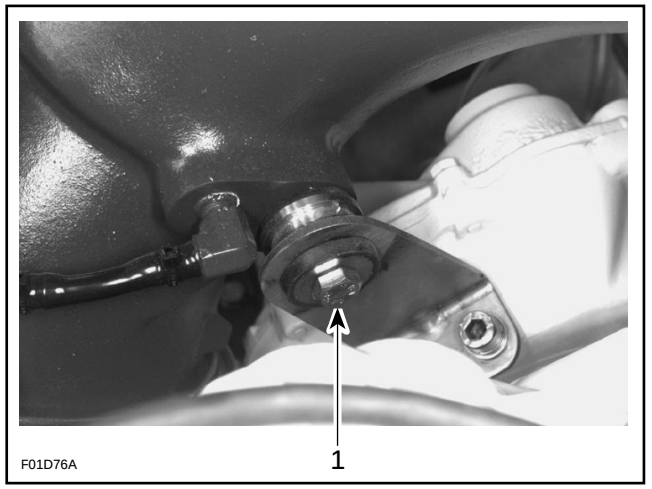
7,8,9, Screw, Nut and Flat Washer

Remove screws and nut with flat washers at tuned pipe head flange.



23, Screw

Remove retaining screw of tuned pipe head.



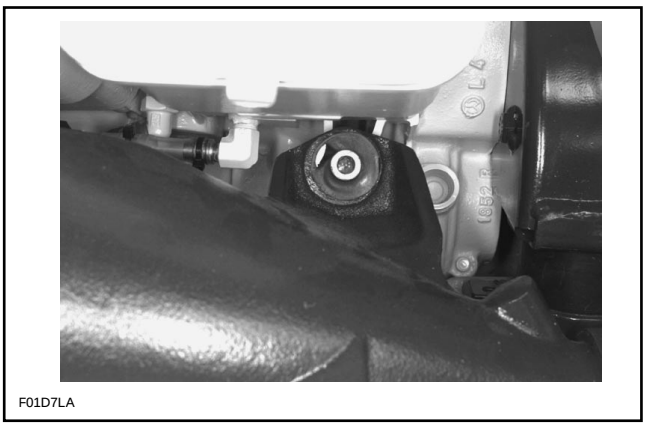
1. *Screw*

Remove tuned pipe head.

6, Screw

Remove two screws retaining tuned pipe cone to engine.

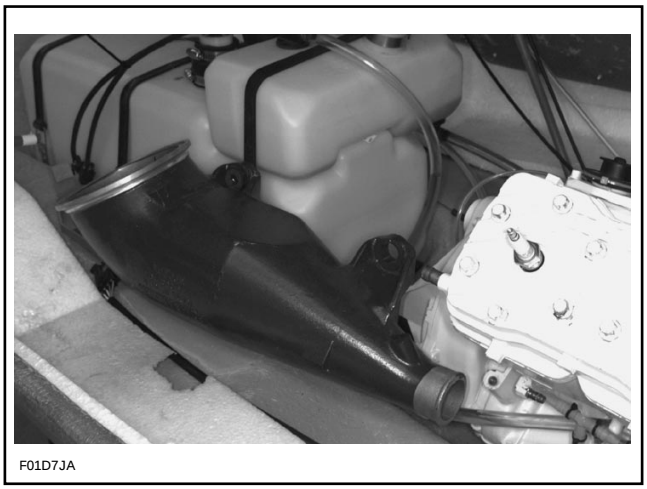




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12, Tuned Pipe Cone

Move tuned pipe cone in front of bilge between body and fuel tank.


F01D7JA

Open storage cover and remove basket. Then, pull out tuned pipe cone through storage compartment opening.

EXHAUST MANIFOLD REMOVAL

XP Model Only

Remove air intake silencer and carburetors. Refer to FUEL SYSTEM 06-02 for proper procedure.

All Models

14,24, Screw and Lock Washer

Remove eight screws and washers then withdraw exhaust manifold.

MUFFLER REMOVAL

All Models Except HX

Disconnect hoses from muffler.

Disconnect hoses of the water flow regulator valve (XP model only).

2, Strap

Disconnect retaining strap of muffler.

13, Muffler

Pull muffler out of bilge.

HX Model Only

1, Collar

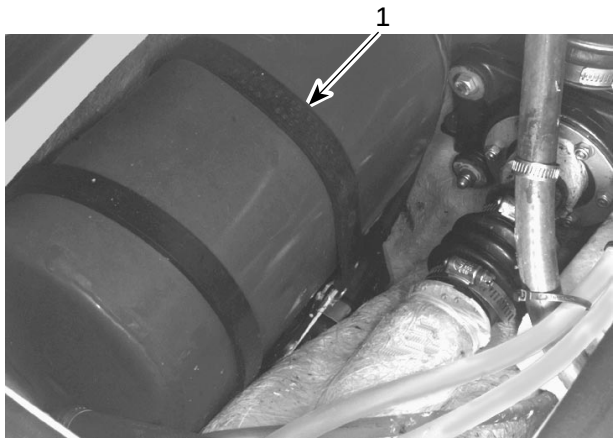
Loosen exhaust hose collar at tuned pipe cone outlet (only if tuned pipe cone is not removed).

2, Strap

Remove rear access cover from body.

Disconnect upper exhaust hose in front of muffler.

Disconnect retaining strap of muffler.



F05D07A

1. Strap

13, Muffler

Pull muffler out of bilge.

NOTE : Lower exhaust hose of muffler may be disconnected or left with muffler.

TUNED PIPE REPAIR

This procedure is given to repair tuned pipe cracks using T.I.G. welding process.

Procedure

- Sand the cracked area to obtain bare metal.
- Perform a 1.50 mm (1/16 in) depth chamfer over crack.
- Use pure argon gas with 5.55 mm (3/32 in) tungsten electrode (puretung “green”, zirtung “brown”) and AC current.
- Use a 5.55 mm (3/32 in) aluminum welding rod (no. 4043), to fill crack.
- Sand welding slightly to remove material surplus.

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Test :

– Use compressed air at 124 kPa (18 PSI) to pressurize tuned pipe.

NOTE : Prior to verify leaks, plug all holes and pressurize tuned pipe while immerging it in water.

CAUTION : Always ensure water passages are not blocked partially or completely while welding tuned pipe.

EXHAUST MANIFOLD, TUNED PIPE AND MUFFLER INSTALLATION

Installation is essentially the reverse of removal procedures. However, pay particular attention to the following.

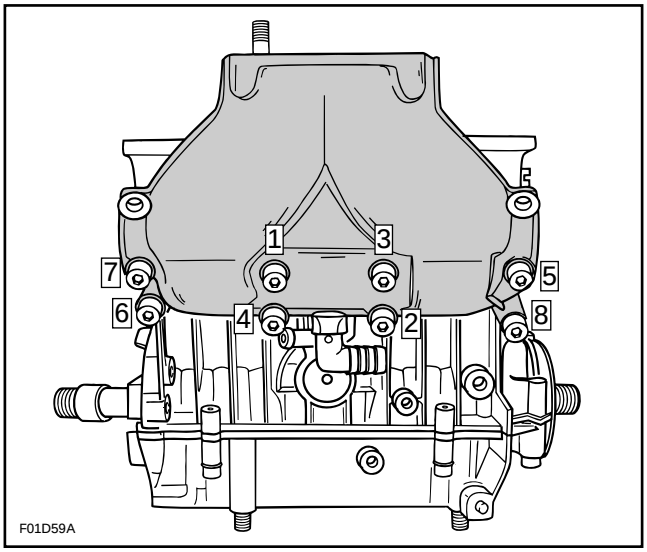
14,15,17,24, Screw, Exhaust Manifold, Gasket and Lock Washer

Make sure gasket(s) are properly positioned prior to finalizing manifold installation.

All Models Except XP

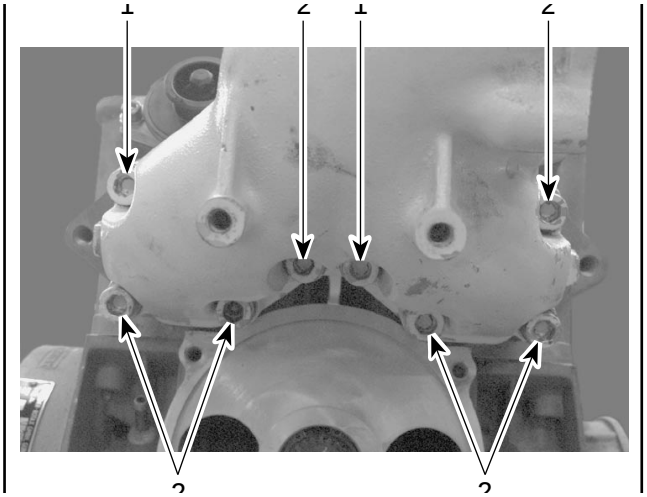
Apply synthetic grease on screw threads.

Install and torque screws to 24 N•m (17 lbf•ft) as per following illustrated sequence.



XP Model Only

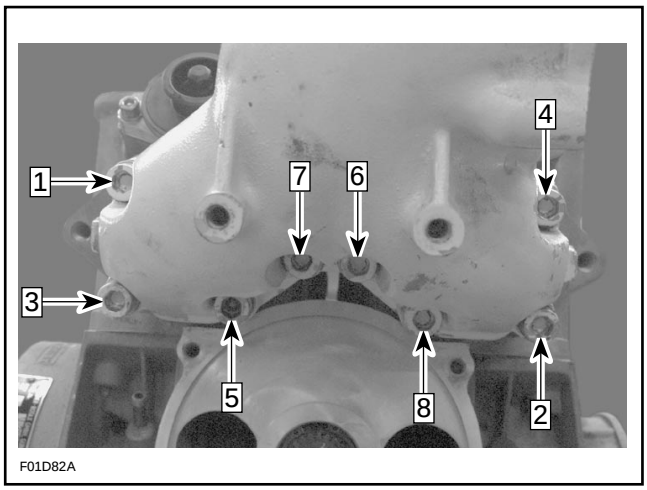
Except for two screws, apply synthetic grease on screw threads. Apply Loctite 515 on the other two screws. Install screws. Refer to the following illustration for position of screws.



1. Screw with Loctite 515
2. Screw with synthetic grease

Torque exhaust manifold screws to 24 N•m (17 lbf•ft) as per following illustrated sequence. Repeat the procedure, retightening screws to 40 N•m (30 lbf•ft).

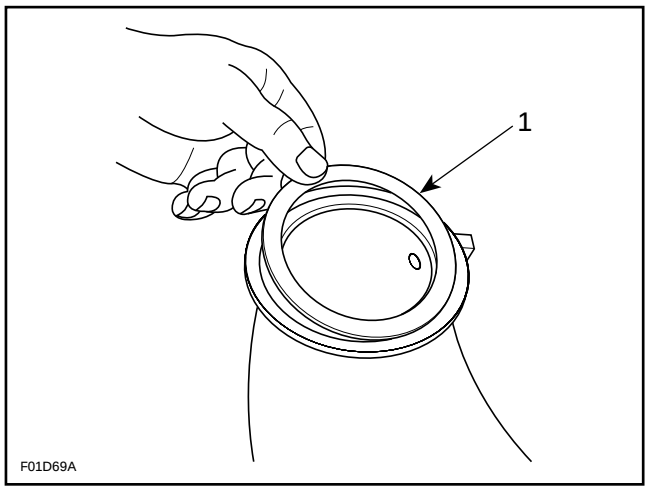
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16, Sealing Ring

HX and XP Model Only

Make sure to install the sealing ring on tuned pipe cone if it was removed.



TYPICAL

1. Sealing ring

Apply a thin layer of heat resistant sealant (P/N 413 709 200) all around sealing ring.

All Models

18,19, Sleeve and Rubber Bushing

Ensure rubber bushings and sleeve are not damaged and are properly installed into tune pipe support(s).

▼ CAUTION : Damage to bushings and/or sleeve will eventually cause stress to tune pipe and may cause cracking.

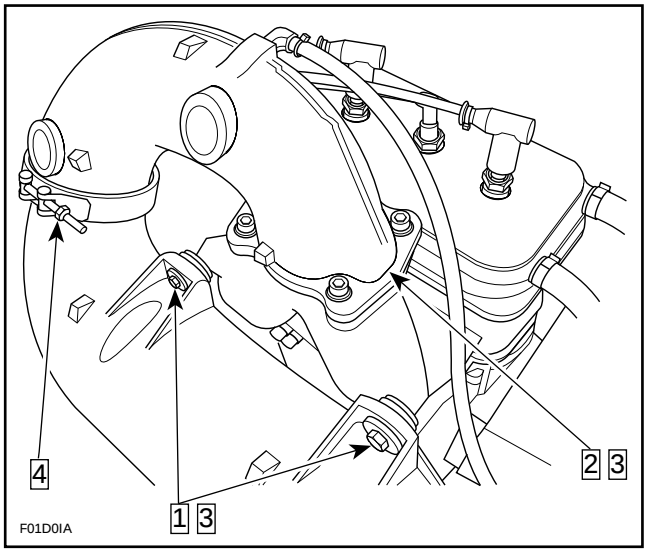
20, Gasket

Make sure that gasket is properly located on exhaust manifold prior to finalizing pipe installation.

4,6,7,8,23, Clamp, Screw and Nut

Apply Loctite 242 (blue) on stud and retaining screw threads. Hand-tighten nut and screws and assure that tuned pipe bushing(s) rests against manifold.

Refer to the following illustration for the torquing sequence.



TYPICAL

Step 1 : Torque screw(s) of tuned pipe cone to 12 N•m (9 lbf•ft)
Step 2 : Torque nut and screws of tuned pipe flange in a criss-cross sequence to 12 N•m (9 lbf•ft)
Step 3 : Repeat the torquing sequence by retightening all fasteners to 25 N•m (18 lbf•ft)
Step 4 : Torque clamp to 10 N•m (88 lbf•in) (if applicable)

XP Model Only

7,9, Screw and Nut

Torque nut and screws of tuned pipe head flange to 40 N•m (30 lbf•ft).

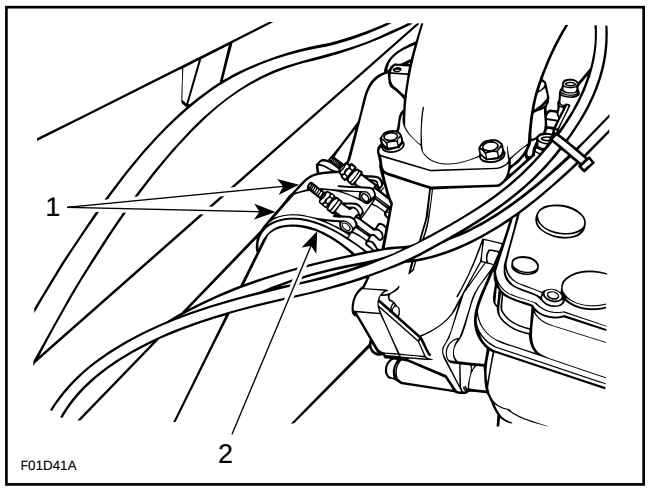
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SPI, SPX, GTS and GTI Models

5,21,22, Tuned Pipe Cone, Collar and Clamp

Install tuned pipe cone with collar and clamp.

Position clamp as illustrated. Do not tighten clamp yet.



1. Clamp
2. Exhaust collar

With hose removed, align cone outlet with muffler inlet.

NOTE : Due to exhaust cone angle, it may have to be rotated to obtain alignment.

Push cone until it touches tuned pipe, then tighten exhaust collar clamp and torque to 10 N•m (88 lbf•in).

CAUTION : There must be no gap between tuned pipe cone and tuned pipe head.

NOTE : Exhaust collar clamp nuts should be tighten alternately to assure no leakage and to obtain specified torque.

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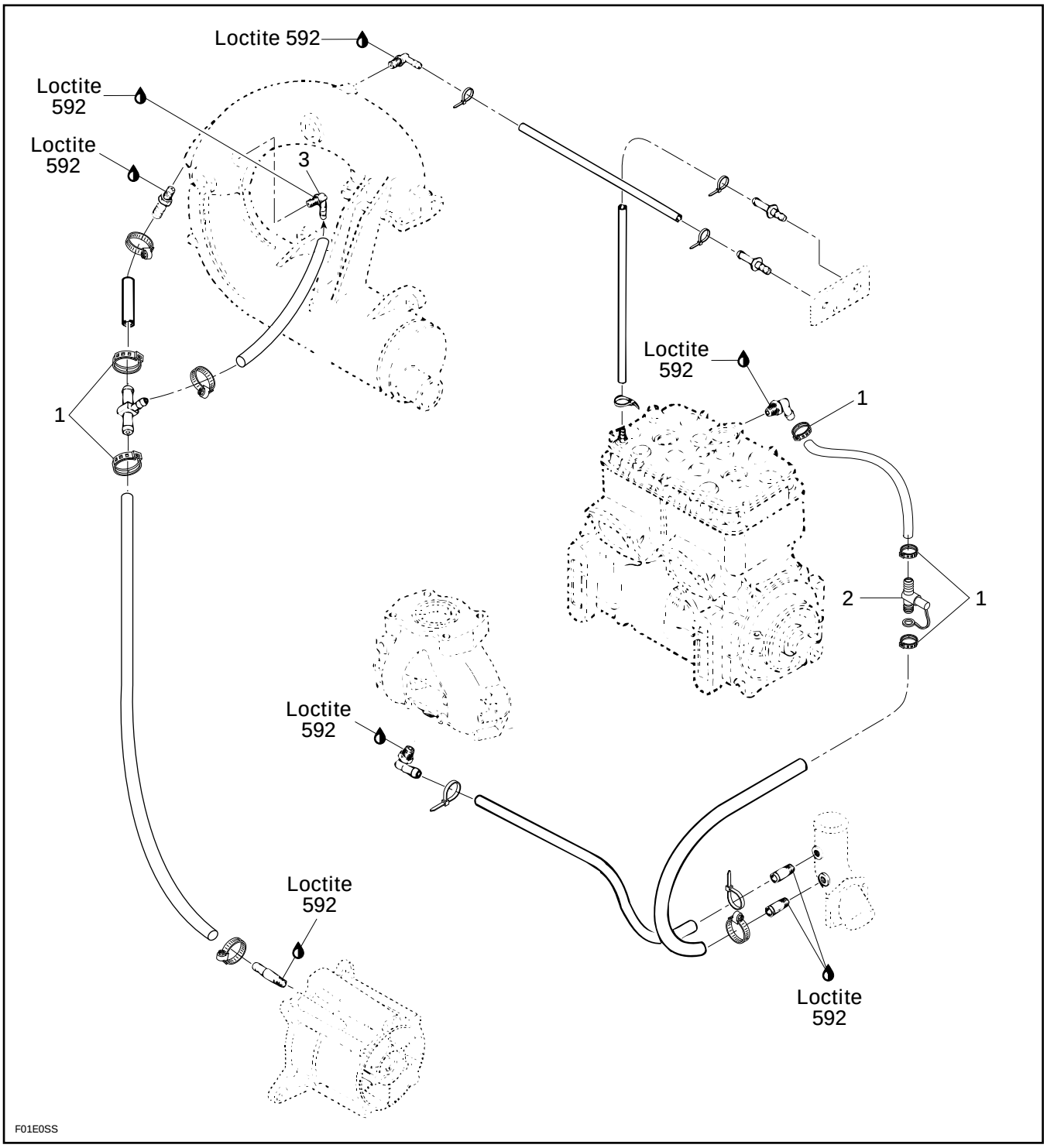
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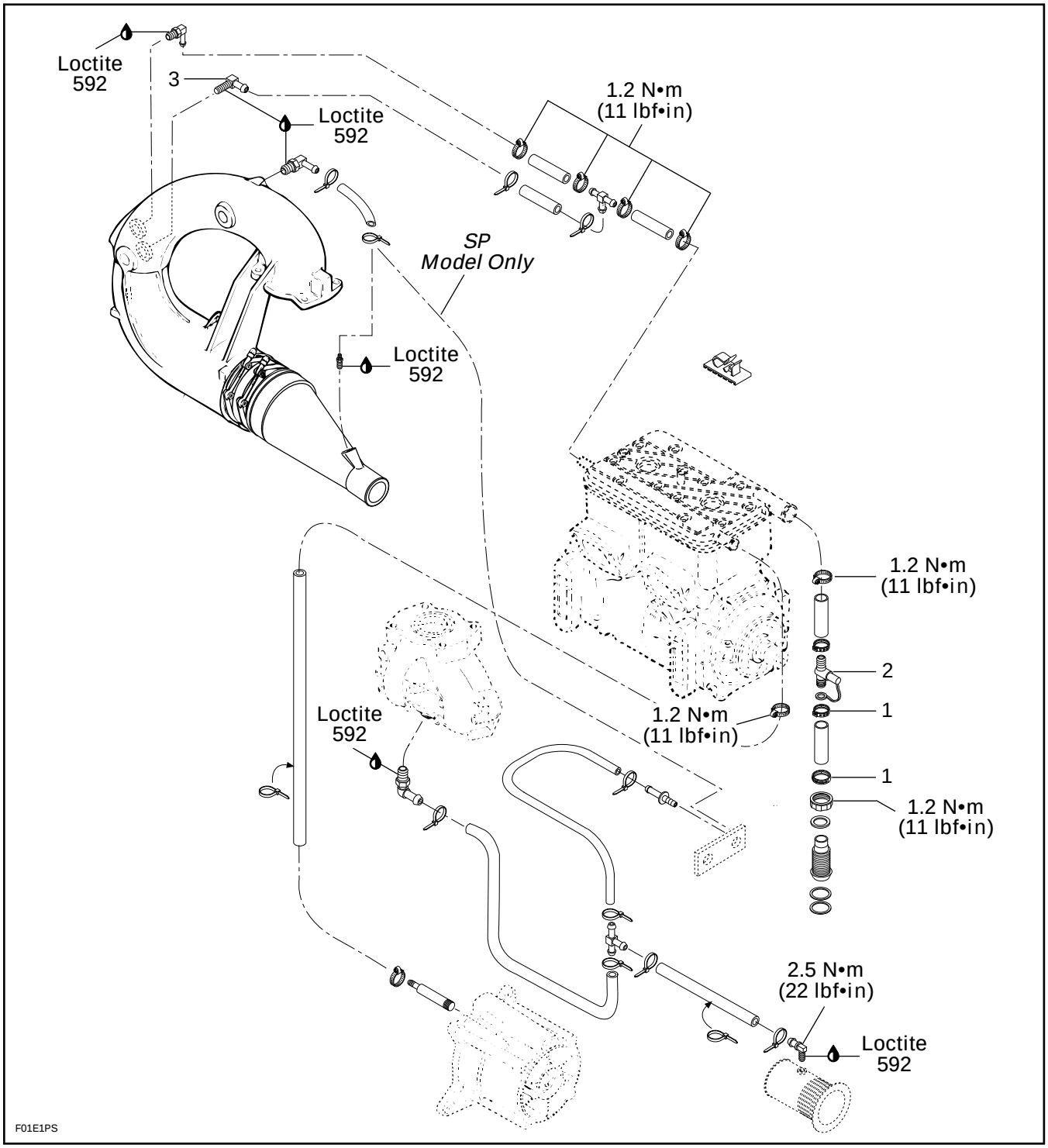
COMPONENTS

SP / SPI and GTS Models



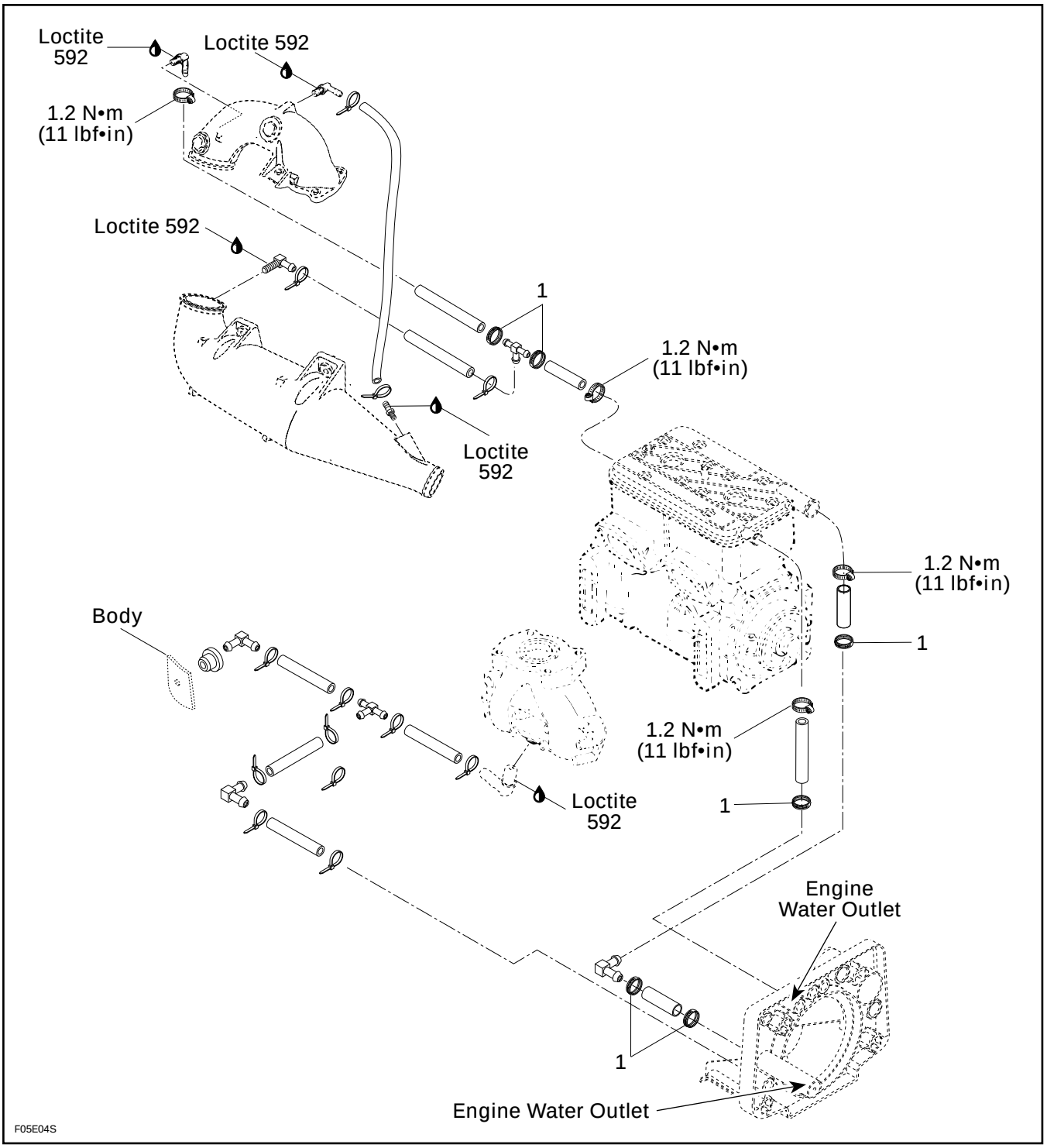
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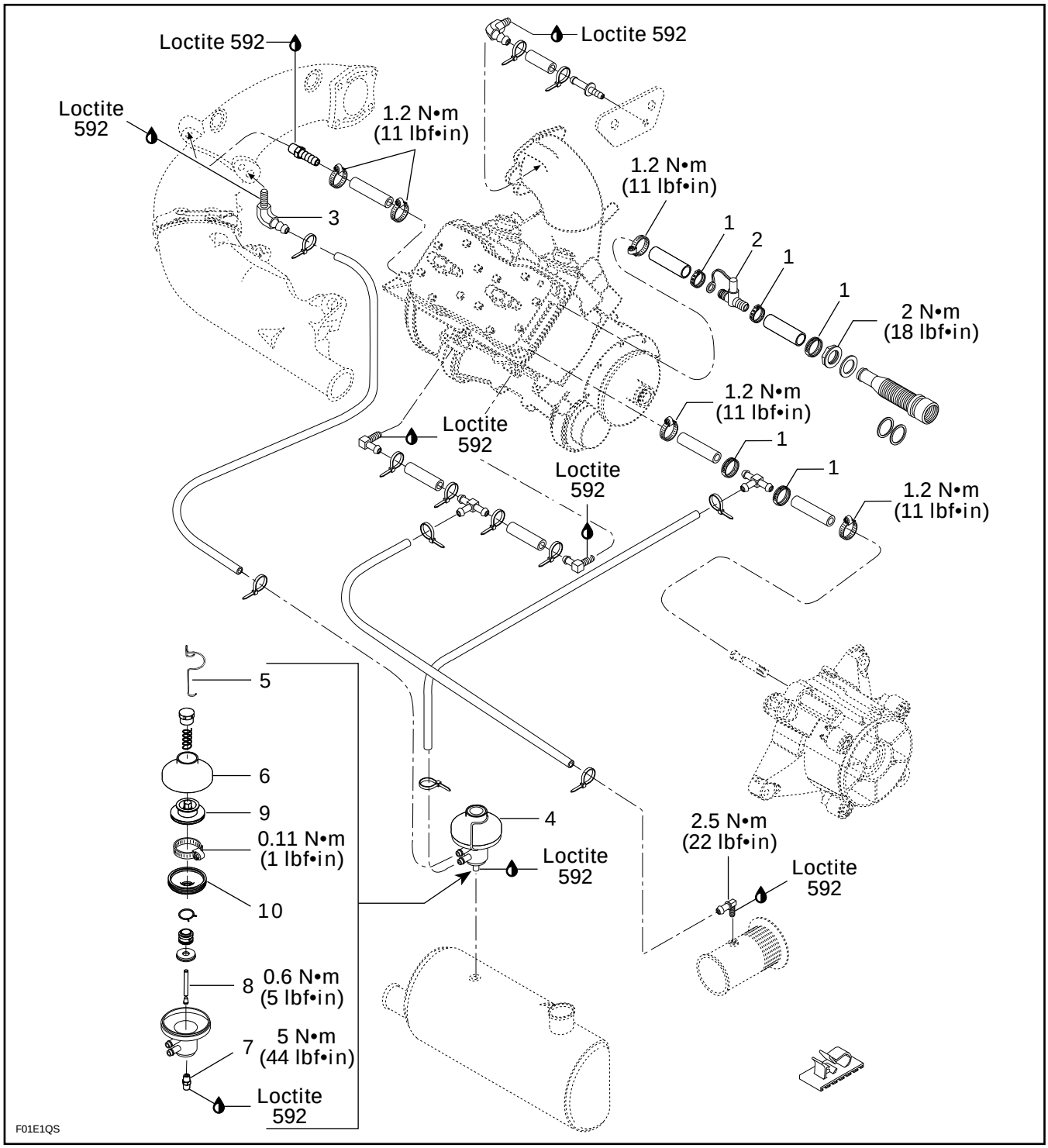
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HX Model



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XP Model



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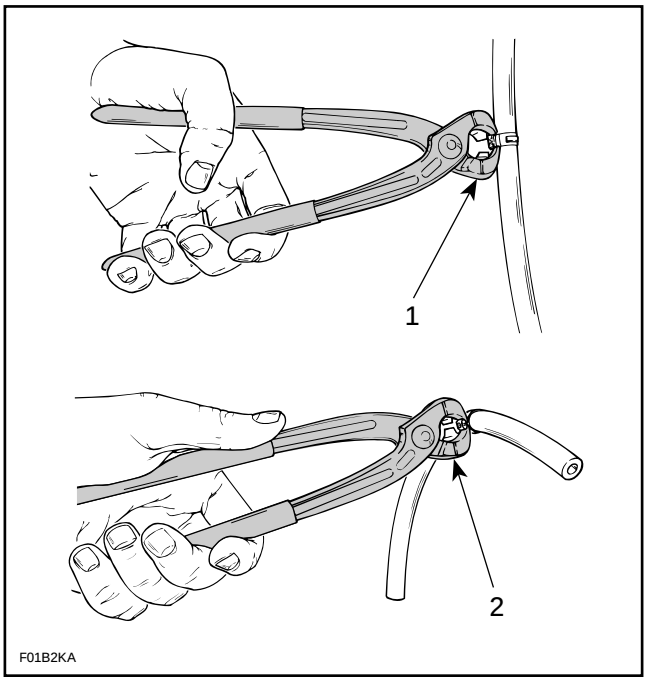
GENERAL

▼ CAUTION : All hoses and fittings of the cooling system have calibrated inside diameters to assure proper cooling of the engine. Always replace using appropriate Bombardier part number.

The Serial Cooling System is utilized on the 717 and 787 engines, which offers an efficient cooling of the combustion chamber to prevent the possibilities of detonation.

1, Clamp

To cut or secure non-reusable Oetiker clamps of cooling system hoses, use pliers (P / N 295 000 070).



1. Cutting clamp
2. Securing clamp

2, Fitting Spigot

The fitting spigot is used to flush cooling system. Refer to MAINTENANCE 02-02.

○ NOTE : The HX model doesn't have a fitting spigot. It has a hose adapter located at the rear of the watercraft.

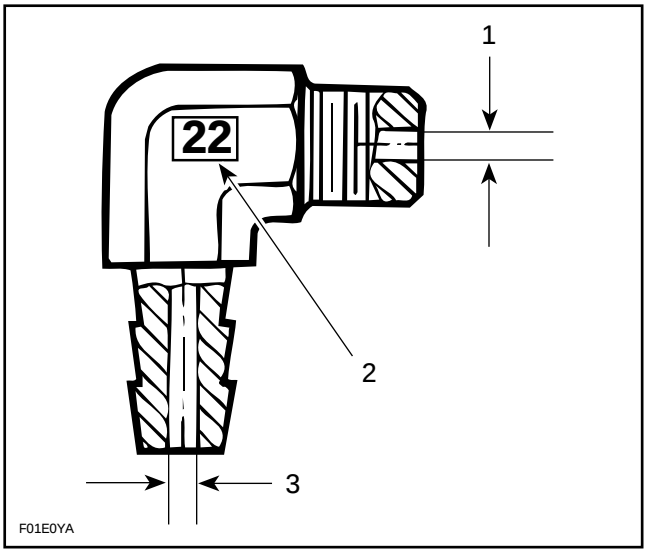
3, Elbow Fitting

Water injection used on exhaust system cools the exhaust gases to obtain maximum performance from the tuned pipe. The elbow fitting has a calibrated inside diameter to optimize water flow in tuned pipe.

The water injection also helps in reducing noise level and cools components of the exhaust system.

▼ CAUTION : The elbow fittings are calibrated and can not be interchanged with one of a different size as severe engine damage could result.

The elbow fitting can be identified by using the number stamped onto the fitting or by measuring its inside diameter. Refer to the following illustration and chart.



TYPICAL

1. Outlet diameter = 4.6 mm (.181 in)
2. Stamped number
3. Inlet diameter = 5.5 mm (.219 in)

Stampe Number on Fitting	Fitting P / N	Inlet Diameter	Outlet Diameter
22	293 700 022	5.5 mm (.219 in)	4.6 mm (.181 in)
24	293 700 024	5.5 mm (.219 in)	3.5 mm (.139 in)
48	293 710 048	4.0 mm (.157 in)	3.5 mm (.139 in)

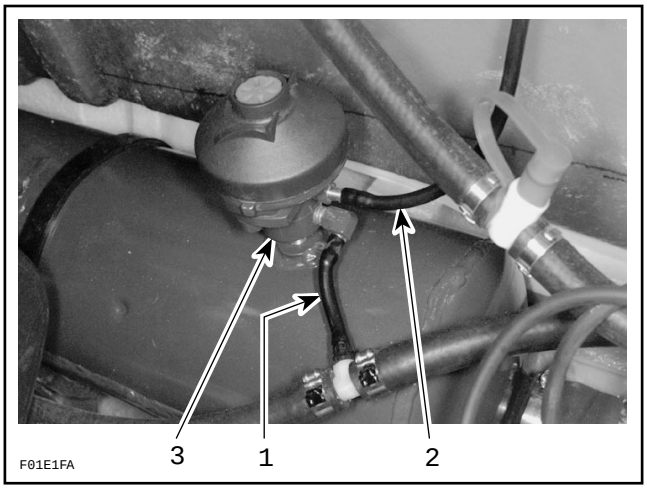
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4, Water Flow Regulator Valve

XP Model

A water flow regulator valve has been developed for the 787 engine so that it can produce the maximum horsepower output and yet maintain the necessary diameter of the injection fitting at the tuned pipe head for unobstructed water flow.

The water flow regulator valve is mounted directly onto the muffler.



1. *Water supply hose of regulator valve*
2. *Regulated water to injection fitting at tuned pipe head*
3. *Water injected into the muffler*

NOTE : The water injected into the muffler is not egulated by the valve. A calibrated water injection fitting of 3.0 mm (.118 in) inside diameter limits water flow into the muffler.

The water flow regulator valve has a calibrated spring and a tapered needle which regulate the injected water in the tuned pipe.

CAUTION : Do not change the calibration of the spring, otherwise serious engine damage can occur.

At low speed, water pressure in the supply hose of the regulator valve is not sufficient to overcome the spring of the regulator valve ; more water is being delivered to the injection fitting at the tuned pipe.

At higher speed, water pressure increases in the supply hose of the regulator valve and gradually overcomes the return spring of the regulator valve. Less water is being delivered to the injection fitting at the tuned pipe.

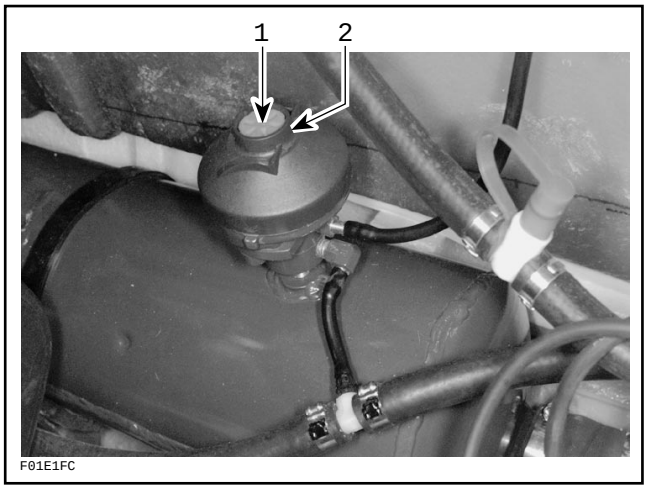
Adjustment

The water flow regulator valve has been calibrated at the factory and should not be modified.

If the maximum engine speed can not be attained or if the engine has poor performance, the water flow regulator valve should be considered in the troubleshooting of the problem.

Mark the location of the red plastic adjustment screw with paint dots for reference purposes.

Fully tighten screw (clockwise) in valve cap.



1. *Turn this screw*
2. *Valve cap*

Turn the screw 3 turns counterclockwise (loosen).

The adjustment is now complete.

NOTE : The water flow regulator valve should deliver 0.4 gallon per minute at maximum engine speed.

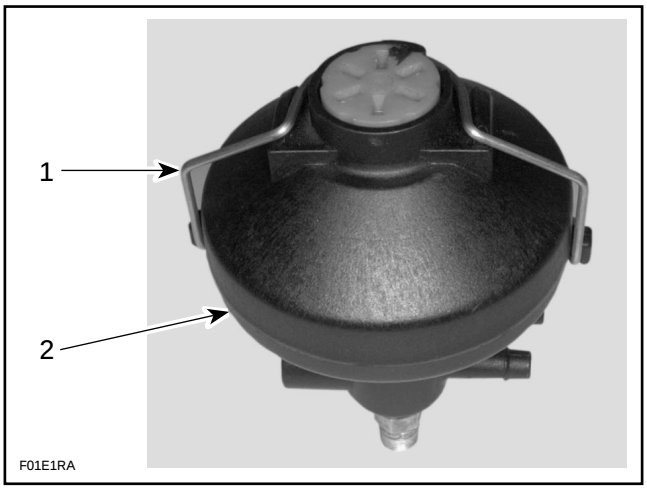
Disassembly

5,6, Spring and Cover

Remove the cover of the valve by releasing the spring.

WARNING : Firmly hold cover to valve base. The spring inside the valve is applying a pressure against the cover.

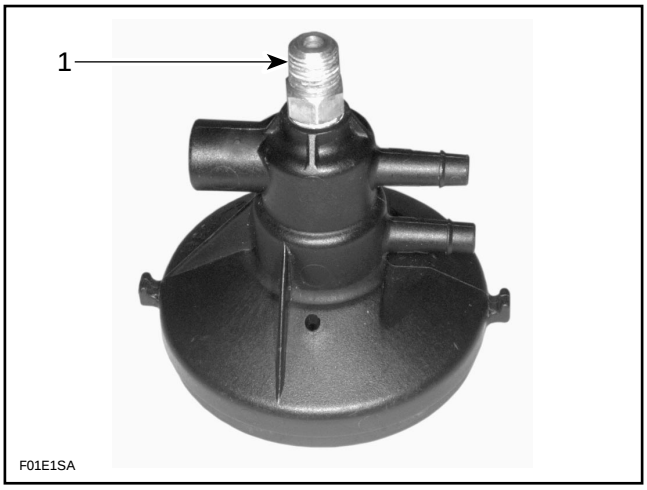
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1. Spring
2. Cover

7, Fitting

Remove fitting from valve housing.

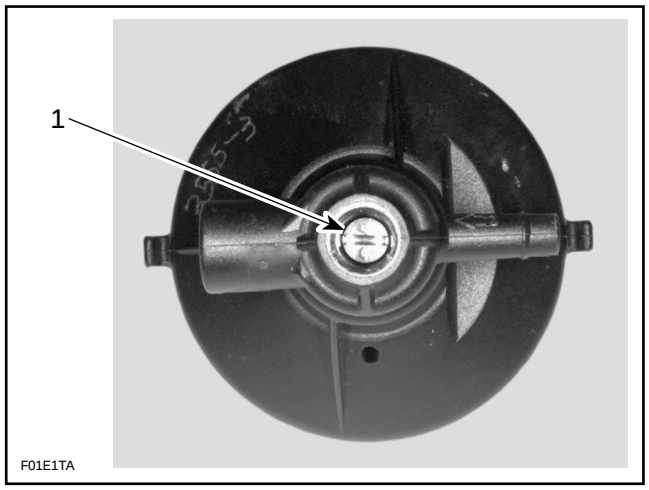


1. Fitting

8, Tapered Needle

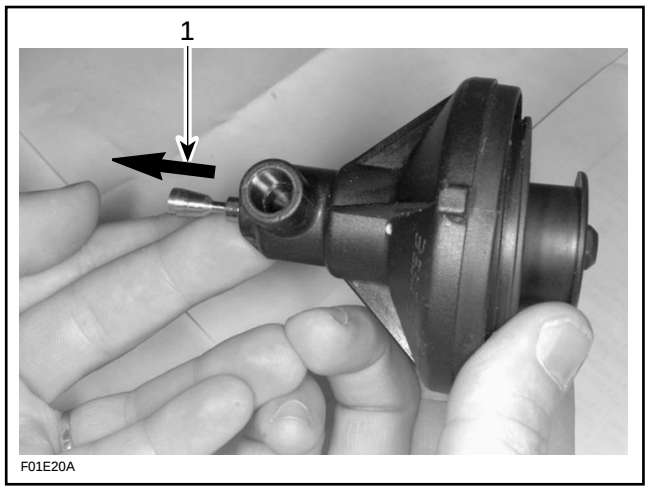
Unscrew the tapered needle.

NOTE : Hold the valve to prevent it from turning.



1. Tapered needle

Remove the tapered needle from valve housing.



1. Remove tapered needle

9,10, Valve and Bellows

Pull the valve slightly. Using pliers, release the clamp which retains the bellows.

Remove valve and bellows.

Inspection

Inspect parts for damage. Verify especially bellows for cracks.

Assembly

Assembly is essentially the reverse of disassembly procedures.

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CIRCUIT

GENERAL

The cooling system is equipped with a fitting spigot for flushing purposes (a hose adapter for the HX model).

For flushing operation, a coupler hose is available (unnecessary for the HX model) to connect to fitting spigot. The other end of coupler hose is to be connected to a garden hose to flush the whole system by backwash. For flushing procedure, refer to MAINTENANCE 02-02.

For winterization of cooling system, refer to MAINTENANCE 02-04.

Special precautions should be taken when towing a Sea-Doo watercraft.

When towing your watercraft pinch the water supply hose from the impeller housing to the engine with the Hose Pincher (large) Pþ/þN 529 030 400.

This will prevent the cooling system from filling which may lead to water being injected into and filling the exhaust system. Without the engine running there isn't any exhaust pressure to carry the water out the exhaust outlet.

▼ CAUTION : Failure to do this may result in damage to the engine. If you must tow a stranded watercraft and do not have a hose pincher be sure to stay well below the maximum towing speed of 24 kmþ/þh (15 MPH).

When finished towing the craft you must remove the hose pincher before operating it. Failure to do so will result in damage to the engine.

The water supply is taken from a pressurized area in the jet pump between the impeller and venturi.

The tuned pipe and exhaust manifold are designed with a double wall to allow water circulation.

Water is pre-heated by the exhaust system before entering the cylinder cooling jackets.

When engine is running, water must flow from bleed outlet(s) indicating that water circulates.

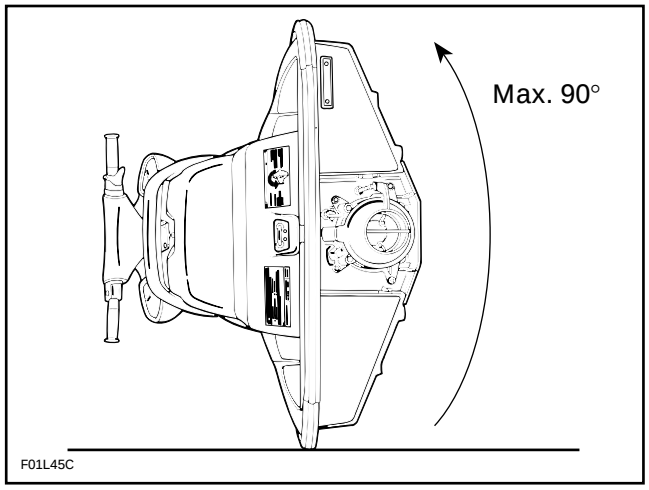
Check monitoring beeper operation by jumping terminal of thermosensor wire to ground. Beeper must operate.

At every verification of monitoring beeper always apply dielectric grease on thermosensor connector.

Verify wire terminal on connector for tightness. If too loose, squeeze terminal slightly at installation.

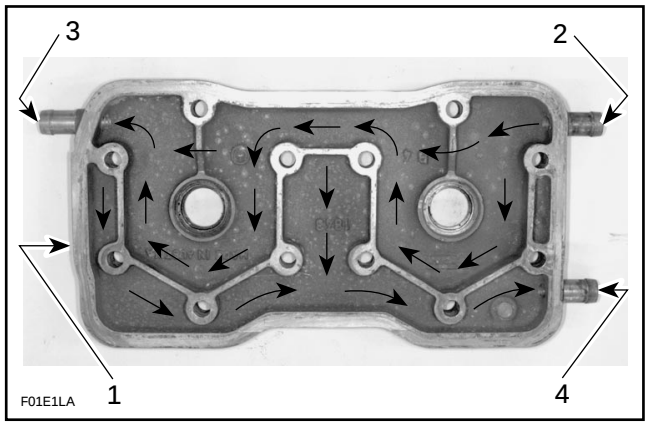
▼ CAUTION : When investigating for no water flow in the cooling system, check all elbows and straight fittings as well as all hoses for blockage.

When servicing the hull, always rotate watercraft counterclockwise (seen from the rear). Rotating watercraft clockwise could allow residual water in tuned pipe to enter the engine and cause damage.



717 and 787 Engines Only

These engines have a Serial Cooling System ; fresh water enters the cylinder head assembly, cooling the combustion chamber to prevent detonations. Then, water exits cylinder head toward tuned pipe.

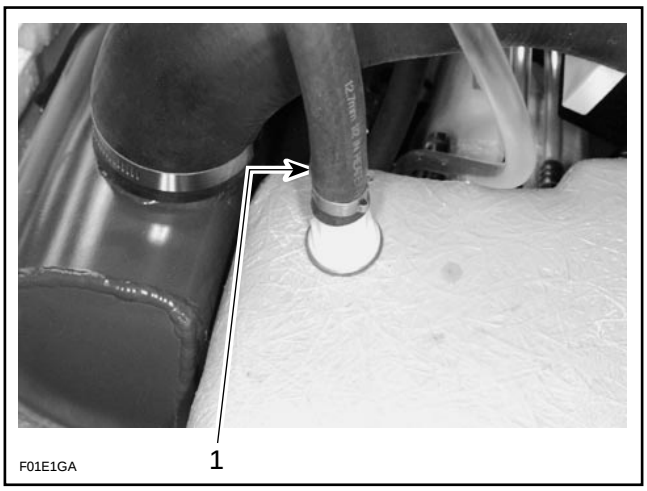


1. *Cylinder head cover*
2. *Fresh water from jet pump*
3. *Water exiting head assembly to tuned pipe, exhaust manifold and cylinders*

A. *Water from cylinder water jackets exiting engine*

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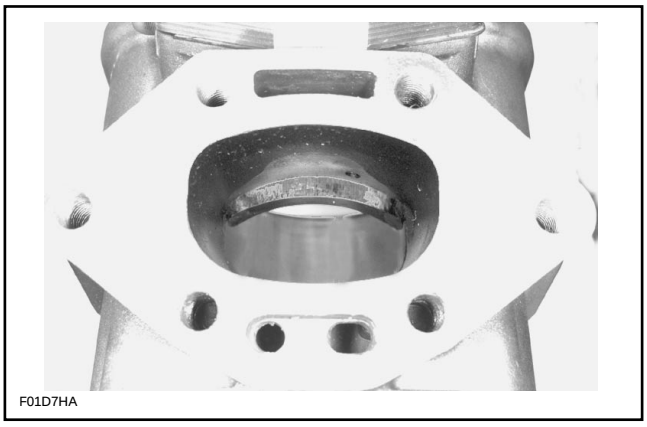
For a minimum back pressure in the exhaust, engine water outlet hose is not connected to the exhaust. It has its own fitting at the rear of the hull.



1. Engine water outlet hose

All engines

Water enters cylinder cooling jacket through passages located below exhaust ports from tuned pipe.



1. Water passages

No water enters crankcase.

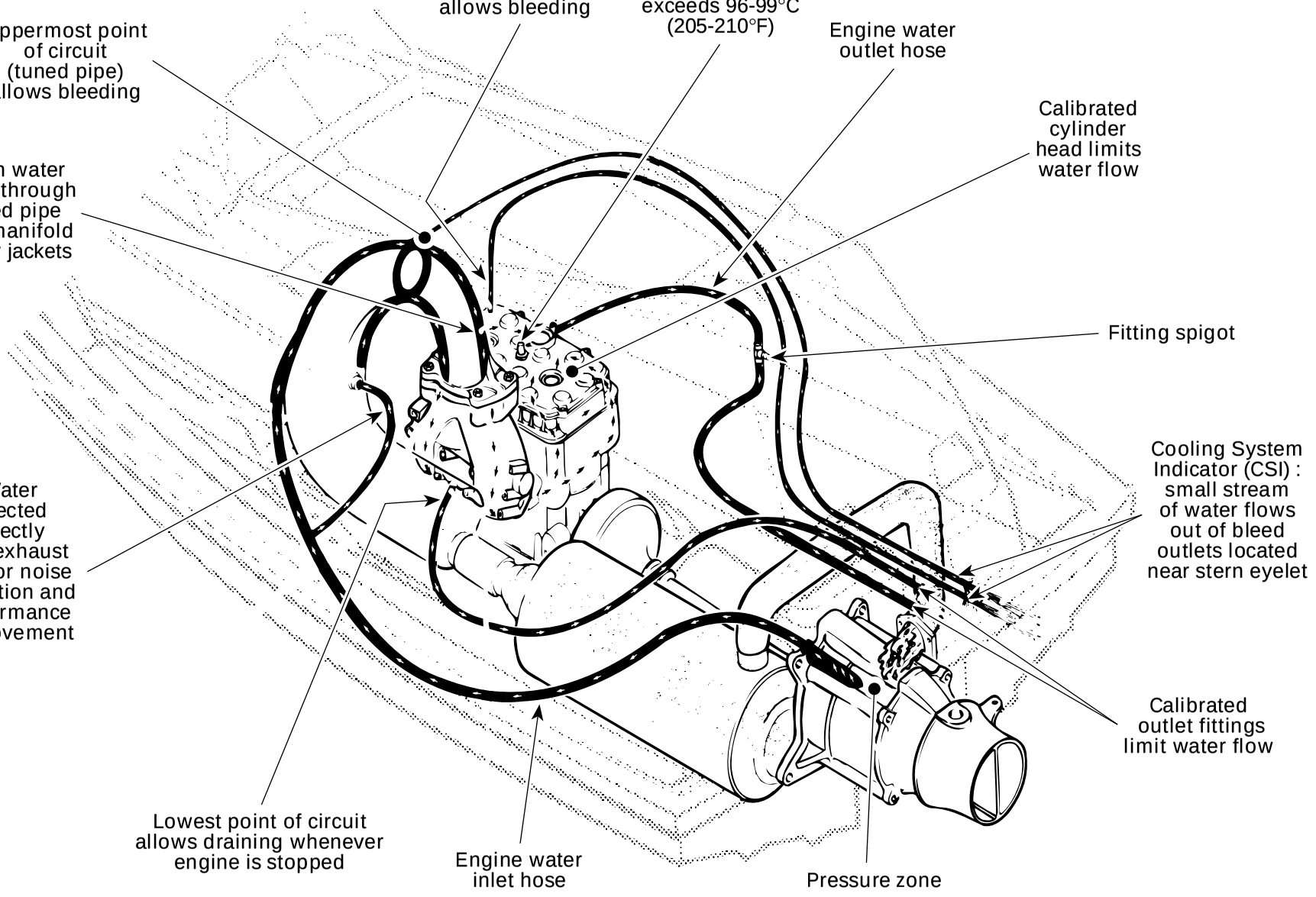
For a complete view of cooling system arrangement, refer to the next pages for each engine model.

▼ CAUTION : Never modify cooling system arrangement, otherwise serious engine damage could occur.

TECHNICAL DATA
TYPE : TLCS (Total Loss Cooling System).
COOLANT FLOW : Pressure build-up at impeller housing (no water pump).
TEMPERATURE CONTROL : Calibrated outlet fittings (no thermostat).
SYSTEM BLEEDING : Self-bleed type (hose at uppermost point of circuit).
SYSTEM DRAINING : Self-drain type (hose at lowest point of circuit).
SYSTEM FLUSHING : Fitting spigot (except HX). Hose adapter (HX).
MONITORING BEEPER : Turns on at 96-99°C (205-210°F).

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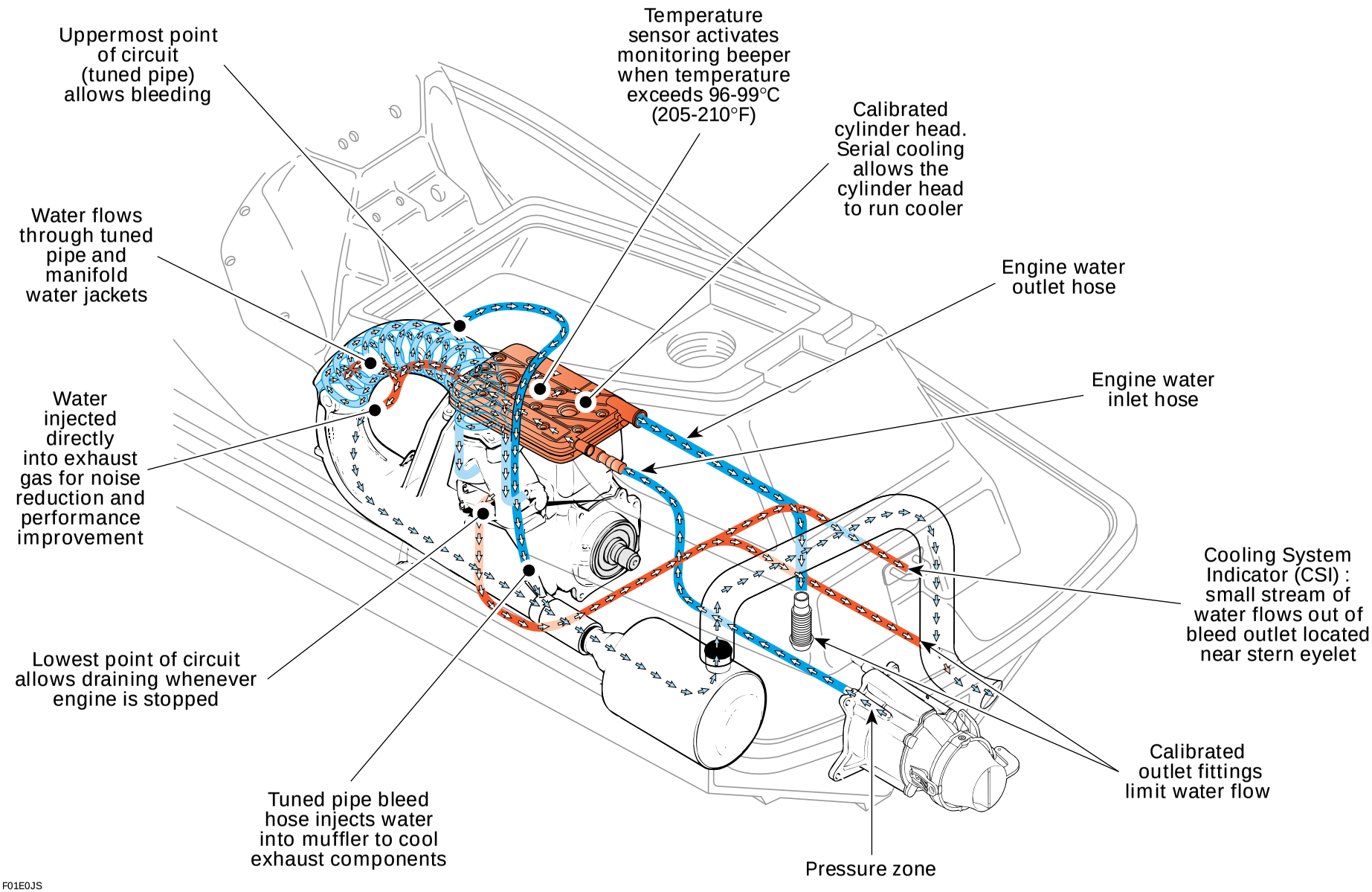
587 ENGINE COOLING SYSTEM



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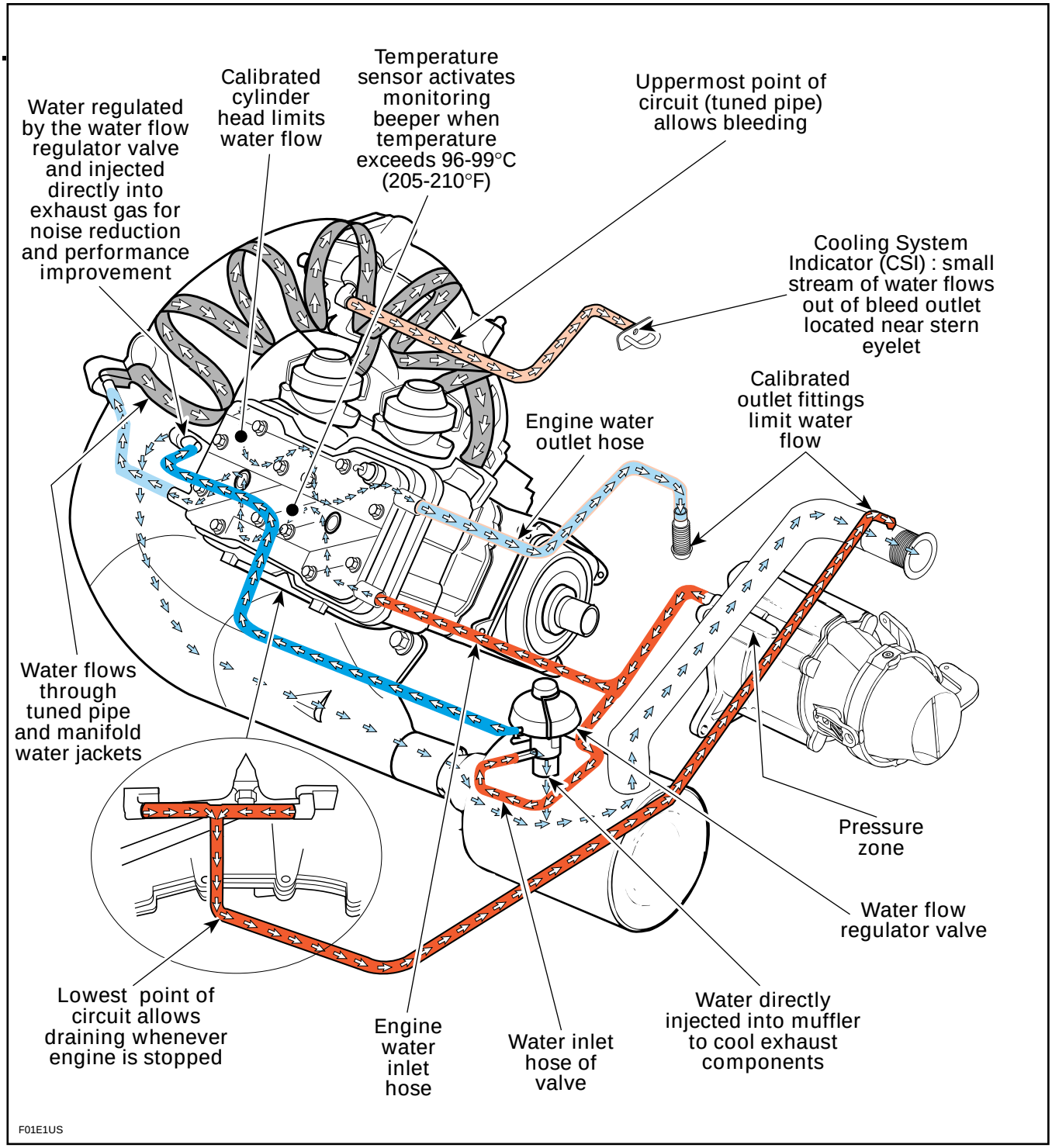
717 ENGINE COOLING SYSTEM



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787 ENGINE COOLING SYSTEM



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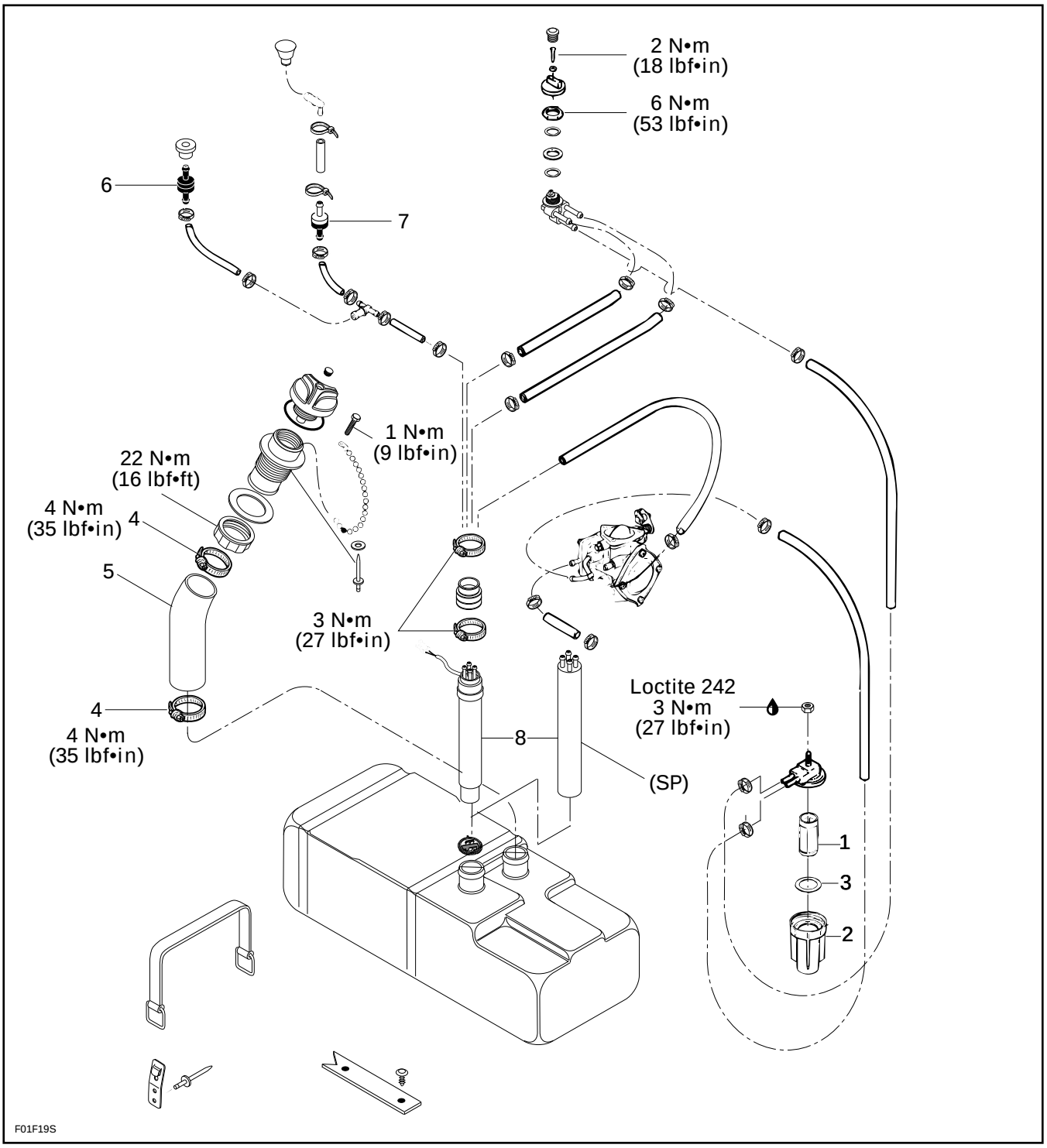
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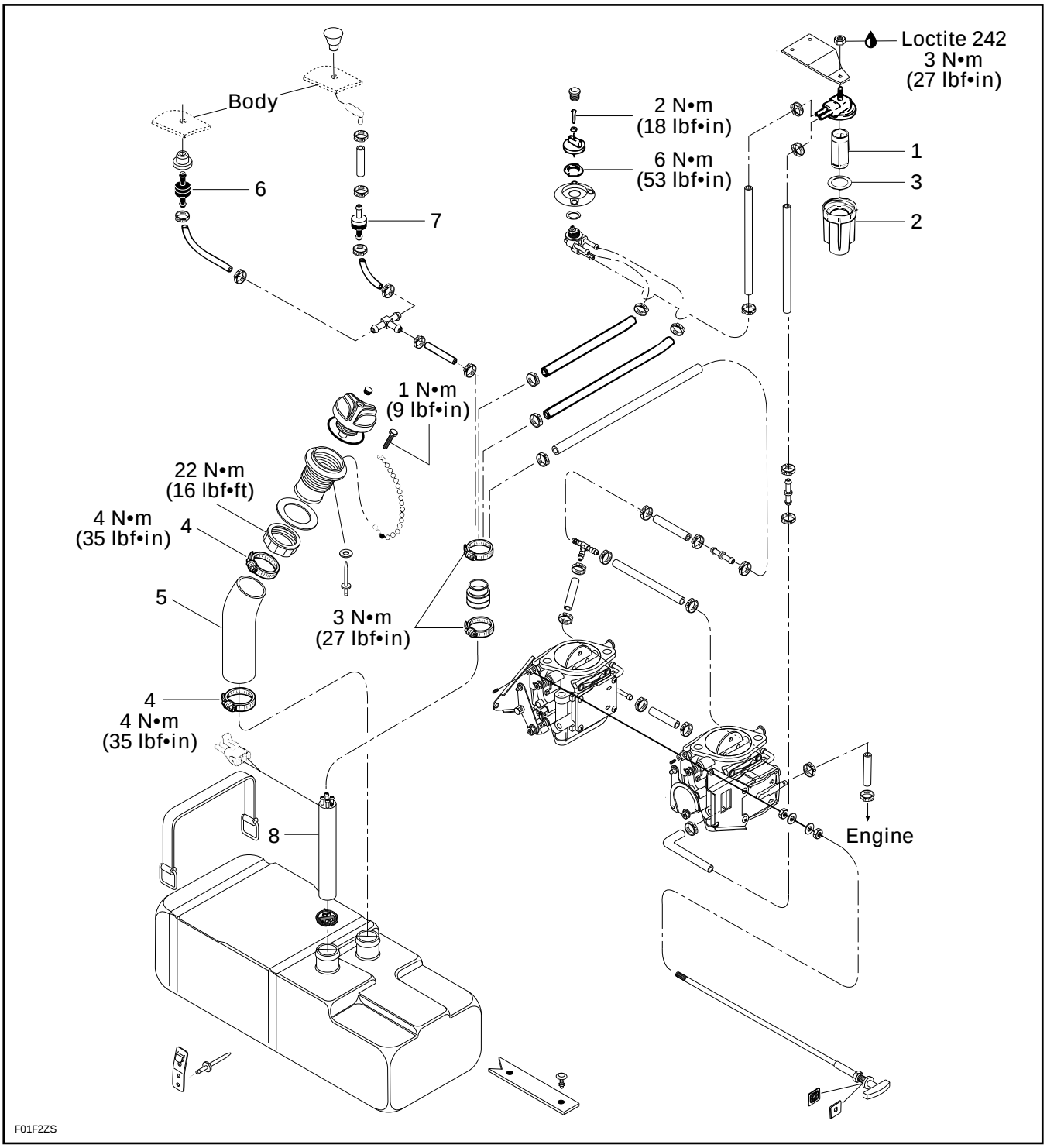
FUEL CIRCUIT

SP, SPI and GTS Models



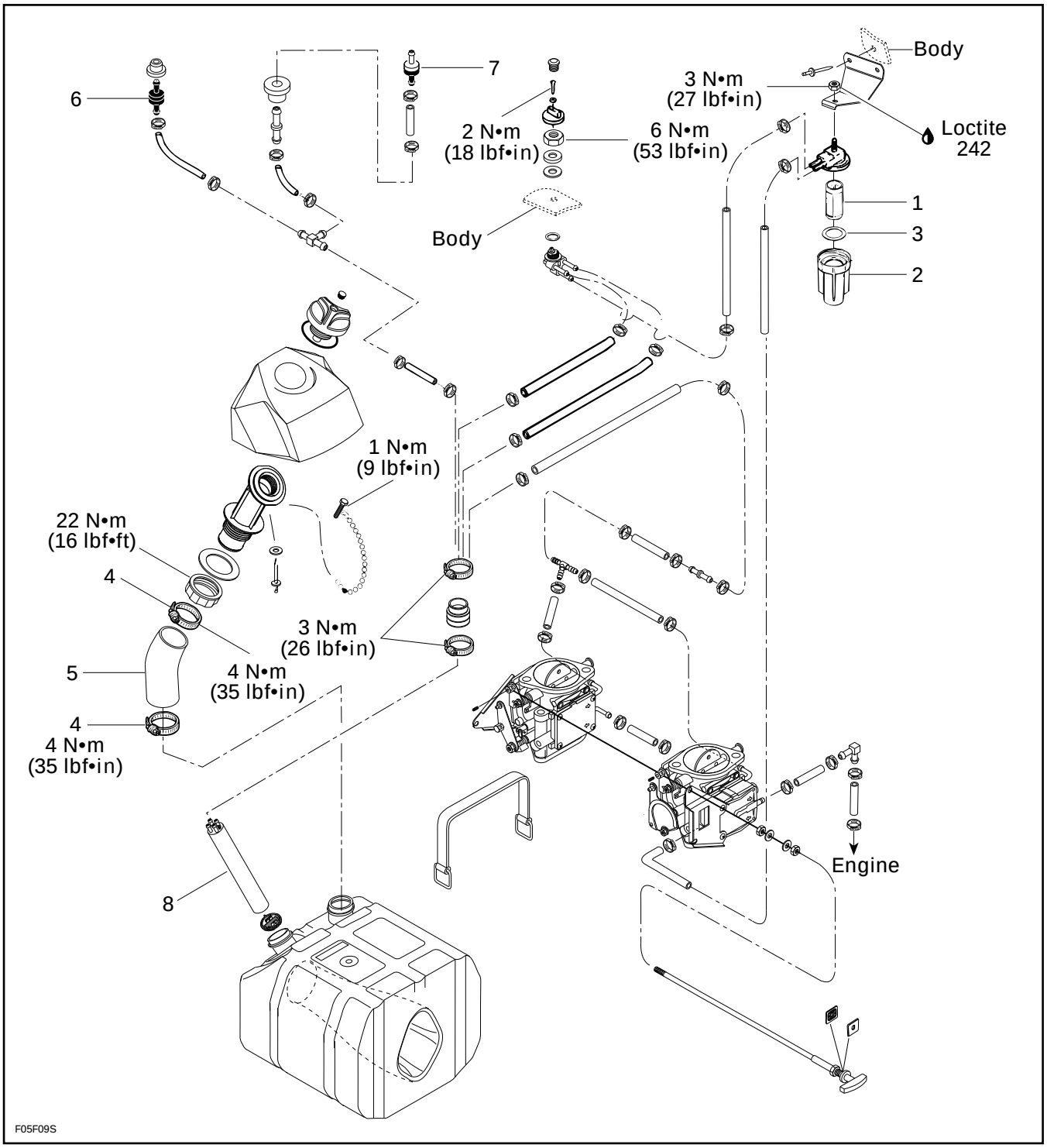
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SPX, XP and GTI Models



PARTS
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HX Model



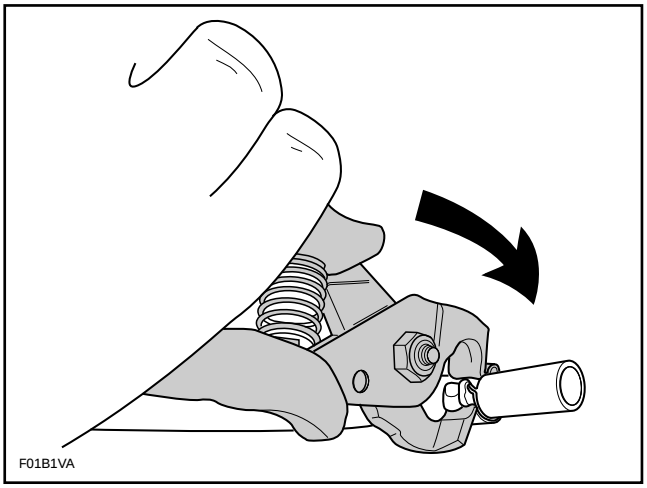
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GENERAL

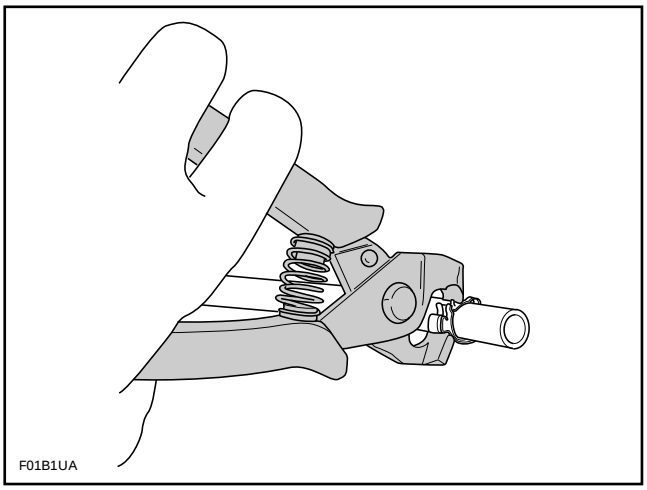
◆ WARNING : Whenever repairing the fuel system, always verify for water infiltration in reservoir.

To open or secure reusable clamps on fuel lines, use pliers (P / N 295 000 054).

To open clamp, place flat side of plier on clamp embossment, squeeze and twist plier.

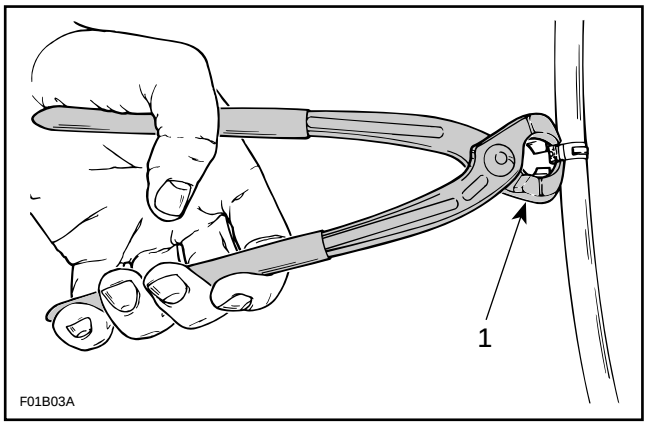


To secure clamp, place notch side of plier on clamp embossment and squeeze plier.

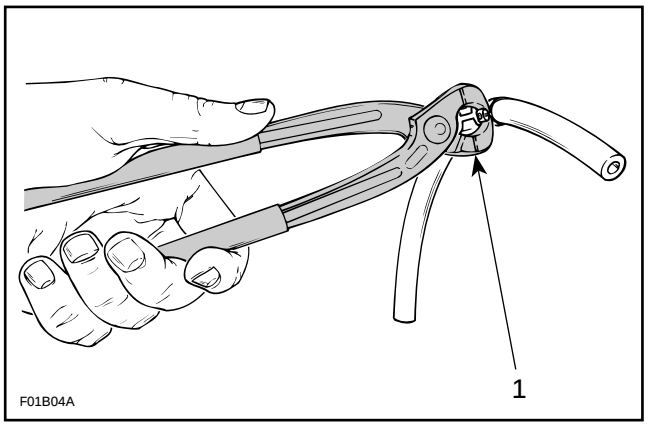


◆ WARNING : Replace any damaged, leaking or deteriorated fuel lines.

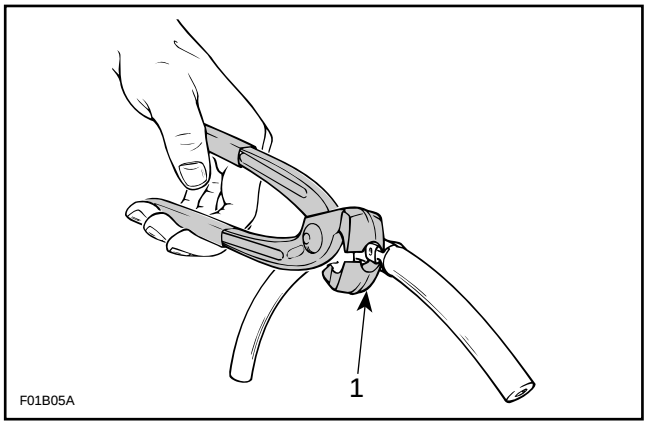
To secure or cut Oetiker clamps on fuel lines, use pliers (P / N 295 000 070).



1. Cutting clamp



1. Securing clamp



1. Securing clamp in limited access

When replacing fuel lines on SEA-DOO watercraft, be sure to use «B1» hoses as available from Bombardier parts department. This will ensure continued proper and safe operation.

◆ WARNING : Use of improper fuel lines could compromise fuel system integrity.

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1,2, Fuel Filter and Bowl

REMOVAL

All Models Except HX

Open storage compartment cover.

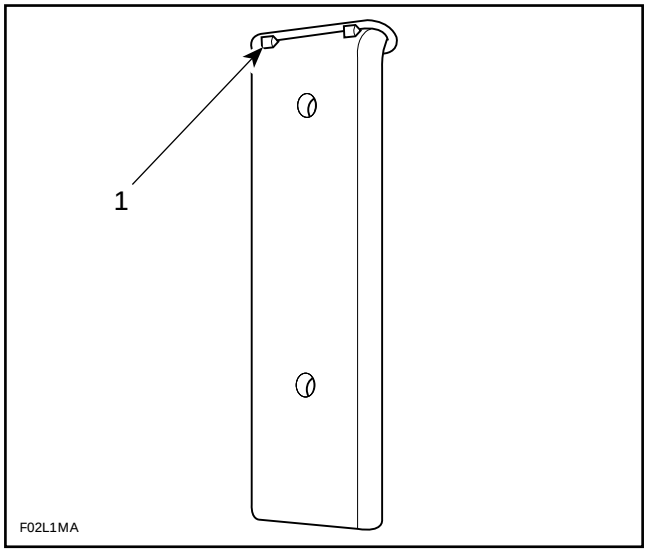
Remove basket.

HX Model Only

Open hood.

GTS and GTI Models Only

Press on vent tube upper part to enable to withdraw tube from body.



TYPICAL

1. Press on vent tube

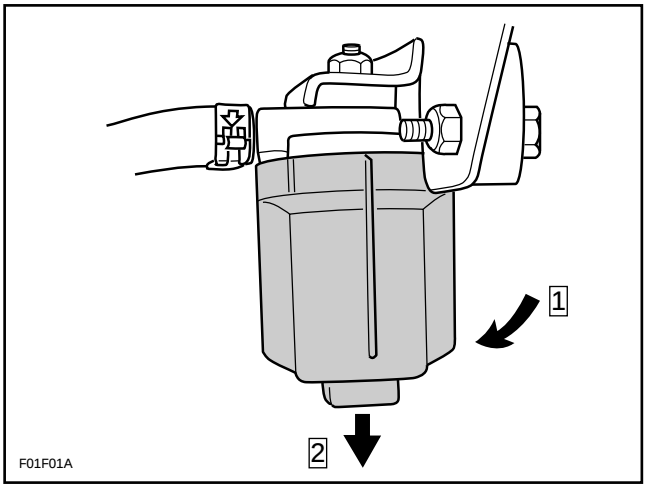
All Models

Turn the fuel valve to OFF position.

◆ WARNING : The engine must not be running and fuel valve must be set to OFF position. Gasoline is flammable and explosive under certain conditions. Always work in a well ventilated area. Do not smoke or allow open flames or sparks in the vicinity.

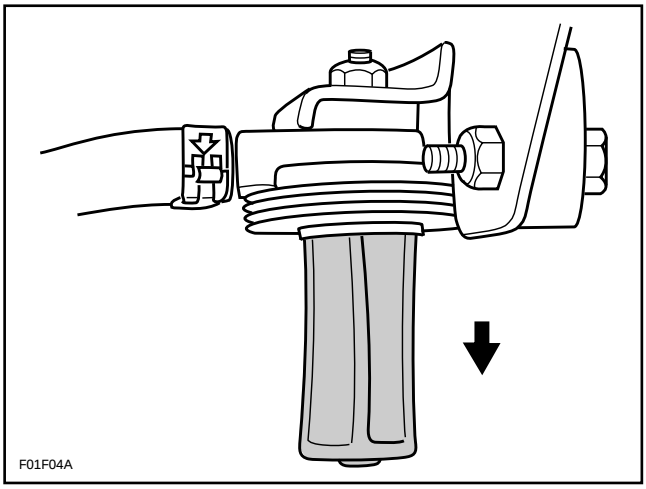
Unscrew fuel filler cap to remove any fuel pressure in system.

Unscrew the fuel filter bowl counterclockwise then pull toward the bottom.



TYPICAL

Pull fuel filter toward the bottom.



TYPICAL

INSPECTION

Check filter bowl for water contamination.

Inspect fuel filter condition. Carefully use low pressure compressed air to clean fuel filter. Replace filter if permanently clogged or damaged.

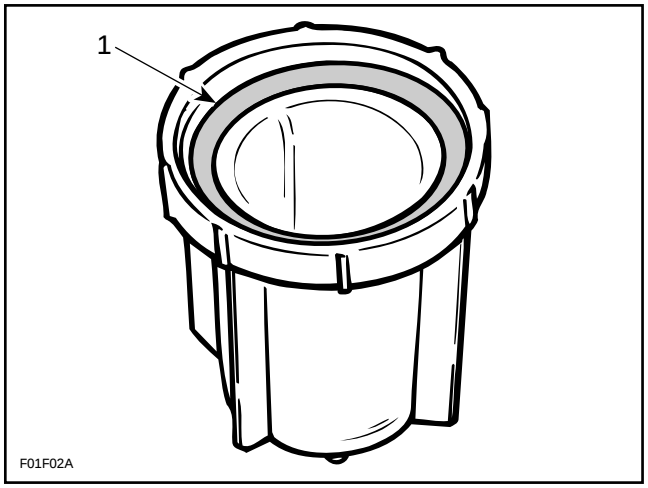
ASSEMBLY

Assembly is essentially the reverse of disassembly procedures. However pay particular attention to the following.

2,3, Bowl and Gasket

Inspect gasket condition. Make sure gasket is well positioned into the filter bowl.

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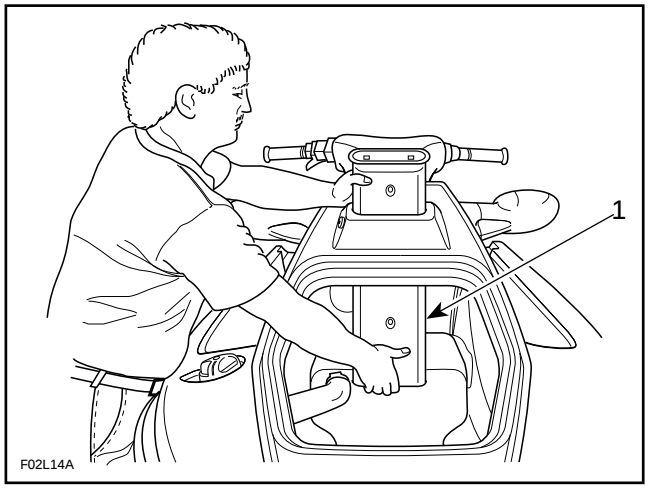
1. Gasket in bowl

◆ WARNING : Ensure that there is no leakage from the fuel filter.

GTS and GTI Models Only

Insert vent tube in body and clip it in place.

◆ WARNING : Vent tube must be in place to provide proper bilge ventilation.



1. Install vent tube

INSPECTION

4, 5, Gear Clamp and Filler Neck Hose

Verify fuel filler neck hose for damage. Always ensure that clamps are well positioned and tightened. Torque clamps to 4 N•m (35 lbf•in).

6, Pressure Relief Valve

This valve will eliminate fuel spillage when the watercraft is upside down. If pressure is built up in fuel system the valve should open at 10 kPa (1.5 PSI) to release the pressure.

◆ WARNING : If pressure relief valve is stuck, the pressure in fuel system will build up and it may cause fuel leakage in engine compartment.

○ NOTE : It is a one-way valve with an arrow to indicate the air flow.

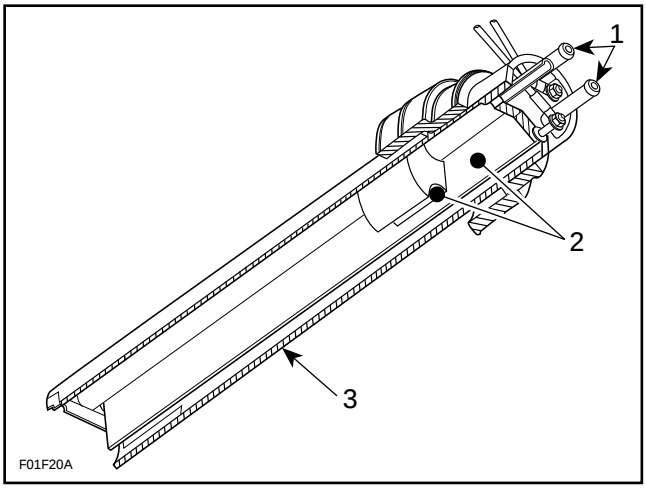
7, Check Valve

Black side of the one-way check valve is the valve outlet. It allows air to get in reservoir.

REMOVAL

8, Baffle Pick Up

○ NOTE : The baffle pick up has an integrated fuel sensor on models which have a fuel gauge.



1. Pick up tube
2. Fuel sensor
3. Baffle pick up

Disconnect BLACK negative cable, then RED positive cable of battery.

◆ WARNING : Always disconnect battery cables exactly in the specified order, BLACK negative cable first. Electrolyte or fuel vapors can be present in the engine compartment and a spark might ignite them and possibly cause personal injuries.

Empty fuel tank.

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◆ WARNING : Fuel is flammable and explosive under certain conditions. Always work in a well ventilated area. Do not smoke or allow open flames or sparks in the vicinity. Always wipe off any fuel spillage from the watercraft.

All Models Except HX

Remove storage basket from watercraft.

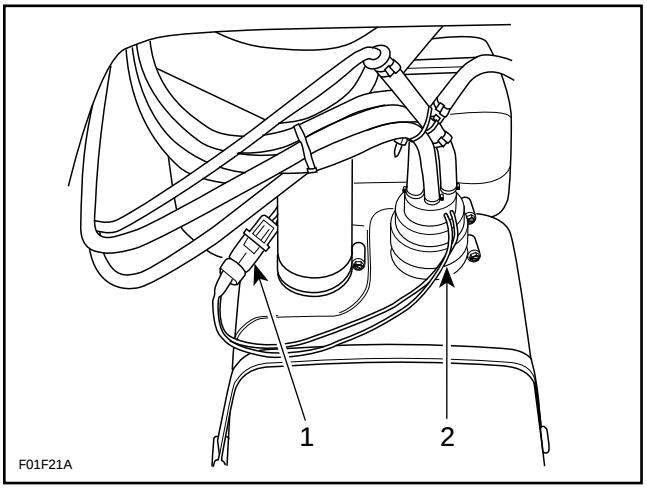
On GTS and GTI models, remove vent tube. Refer to fuel filter removal procedure in this sub-section.

Disconnect filler neck hose from fuel tank.

Remove retaining straps from fuel tank and move tank forward.

Remove hoses from baffle pick up and disconnect wiring harness of fuel sensor (if applicable).

Remove lower clamp from baffle pick up adapter and pull out baffle from fuel tank.

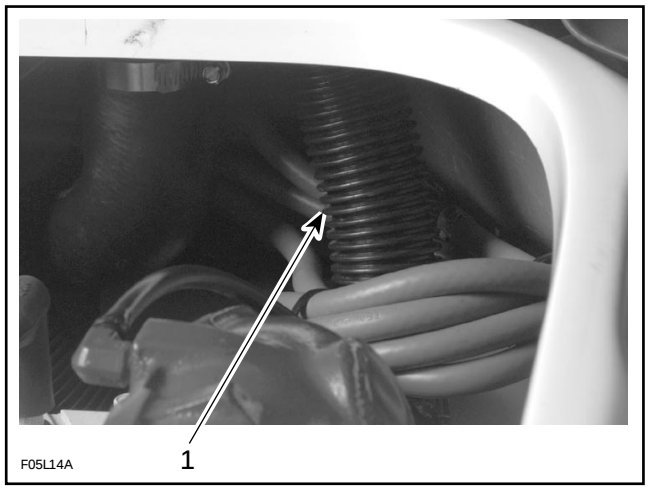


TYPICAL

1. *Wiring harness*
2. *Baffle pick up adapter*

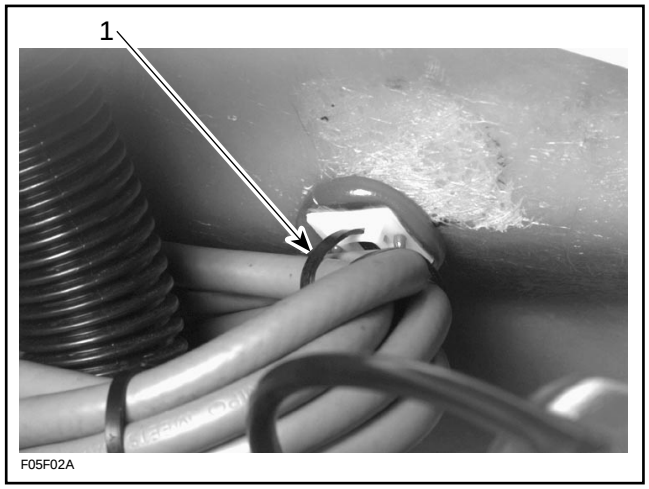
HX Model Only

Pull down left vent tube.



1. *Vent tube*

Cut tie rap retaining fuel hoses to tie-mount.



1. *Cut tie rap*

All Models

Loosen lower clamp of baffle pick up adapter and pull out baffle from fuel tank.

Remove upper clamp from adapter and slide adapter from baffle.

Inspect filter of baffle pick up. Clean or replace as necessary.

ASSEMBLY

Assembly is essentially the reverse of disassembly procedures. However pay particular attention to the following.

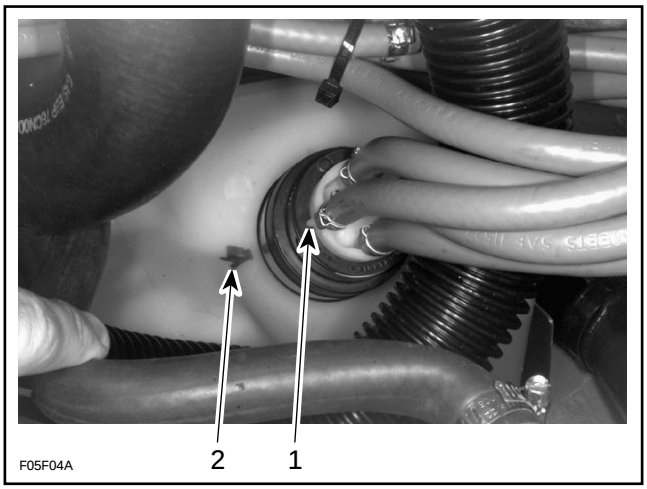
Slide adapter onto baffle pick up until it stops on rib. Install clamp.

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Install baffle pick up into fuel tank and push it until it sits on fuel tank neck. Install clamp and torque both clamps to 3 N•m (27 lbf•in).

HX Model Only

Make sure to align notch of baffle pick up with the mark on the fuel tank.



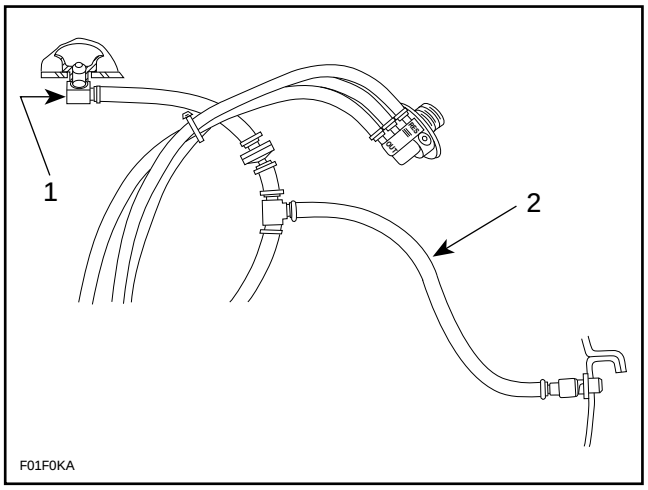
1. Baffle pick up notch
2. Fuel tank mark

FUEL SYSTEM PRESSURIZATION

◆ WARNING : Whenever doing any type of repair on watercraft or if any components of the fuel system are disconnected, a pressure test must be done before starting engine. Ensure to verify fuel line ends for damage. Always cut damaged end beforePressure Test

Proceed as followsþ:

– Fill up fuel tank.
– Disconnect air inlet hose of fuel tank from body.
– Install a hose pincher (P / N 295 000 076) on fuel tank vent hose.



TYPICAL
1. Disconnect air inlet hose
2. Install a hose pincher to vent hose

– Connect pump gauge tester (P / N 295 000 085) to air inlet hose.
– Turn fuel valve to OFF position and pressurize fuel system to 34 kPa (5 PSI). If no leaks are found, turn fuel valve to ON position and pressurize once more.
– If pressure is not maintained locate leak and repair /replace component leaking. To ease leak search spray a solution of soapy water on components, bubbles will indicate leak location.

○ NOTE : The system must maintain a pressure of 34 kPa (5 PSI) during 10 minutes. Never pressurize over 34 kPa (5 PSI).

Reconnect air inlet hose of fuel tank to body.

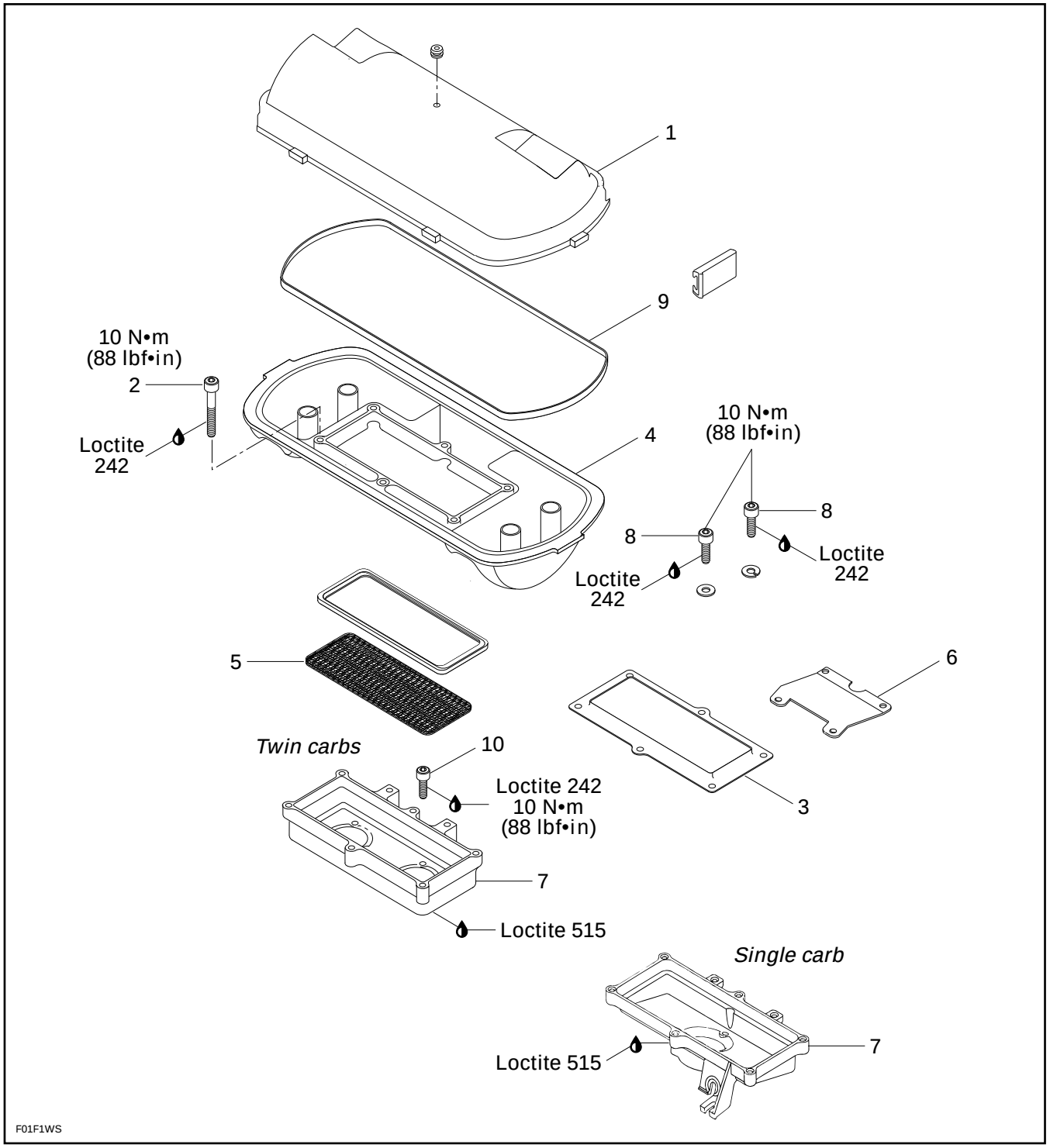
◆ WARNING : If any leak is found, do not start the engine and wipe off any fuel leakage. Do not use electric powered tools on watercraft unless system has passed pressure test.

○ NOTE : Before removing the hose pincher, block with your finger the outlet hole to feel if air is coming out when removing hose pincher. This will indicate that pressure relief valve and the outlet fitting are not blocked.

Remove hose pincher from fuel tank vent hose.

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AIR INTAKE

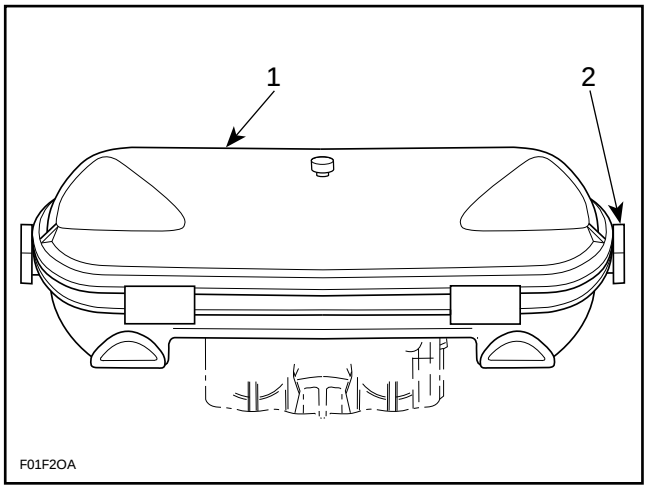


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REMOVAL

1, Air Intake Silencer Cover

Unlock retaining slides holding air intake silencer cover and remove cover.



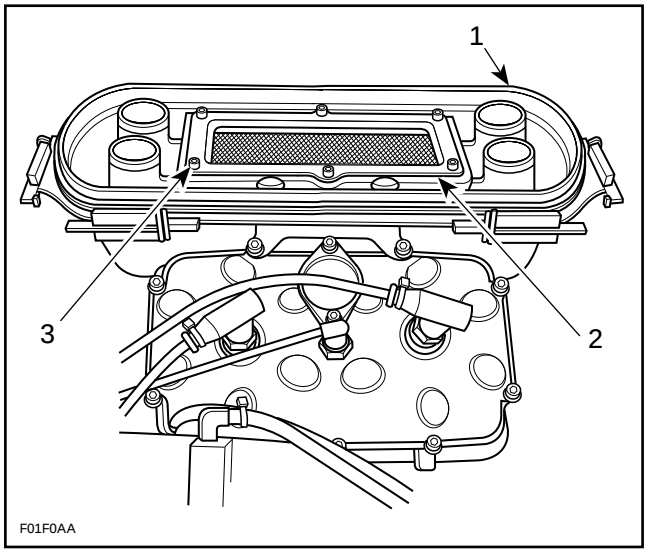
TYPICAL

1. *Air intake silencer cover*
2. *Unlock*

2,3,4, Screw, Plate and Air Intake Silencer Base

Remove screws of plate.

Pull out plate and air intake silencer base.



1. *Air intake silencer base*
2. *Retaining plate*
3. *Remove screws*

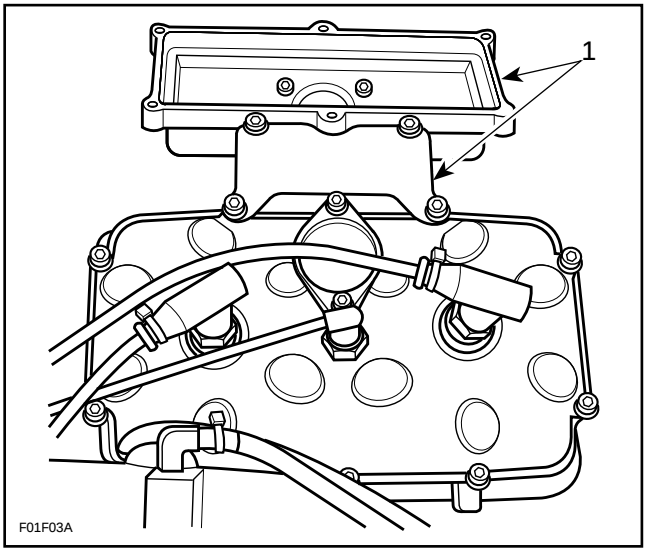
5,6,7,8, Flame Arrester, Support, Base and Screw

Remove flame arrester.

Remove screws holding support of flame arrester base to the cylinder head cover (587 and 717 engines) or to the tuned pipe (787 engine).

Remove screws from flame arrester base then withdraw base.

NOTE : On single carburetor models, remove choke cable from flame arrester base.



1. *Remove support and base*

ASSEMBLY

Assembly is essentially the reverse of removal procedures. However pay particular attention to the following.

CAUTION : Do not modify air intake system, otherwise calibration will be affected.

7,10, Flame Arrester Base and Screw

Apply Loctite 515 on mating surfaces of flame arrester base.

Apply Loctite 242 (blue) on screws and torque to 10þN•m (88þlbf•in).

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5, Flame Arrester

Inspect condition of flame arrester. Replace or clean as necessary.

◆ WARNING : Do not operate watercraft without flame arrester.

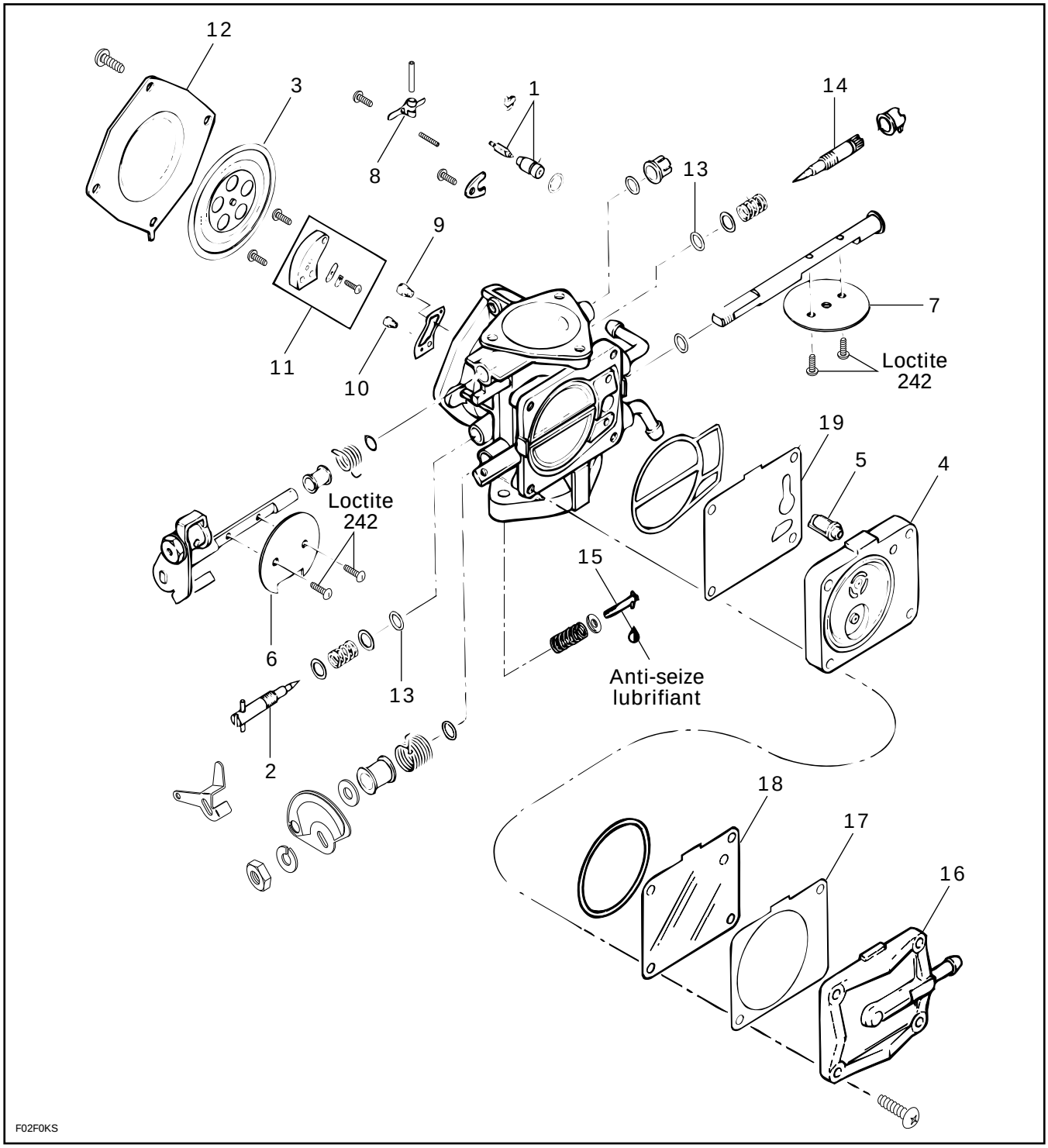
9, Gasket

Inspect condition of gasket. Make sure to properly installed gasket.

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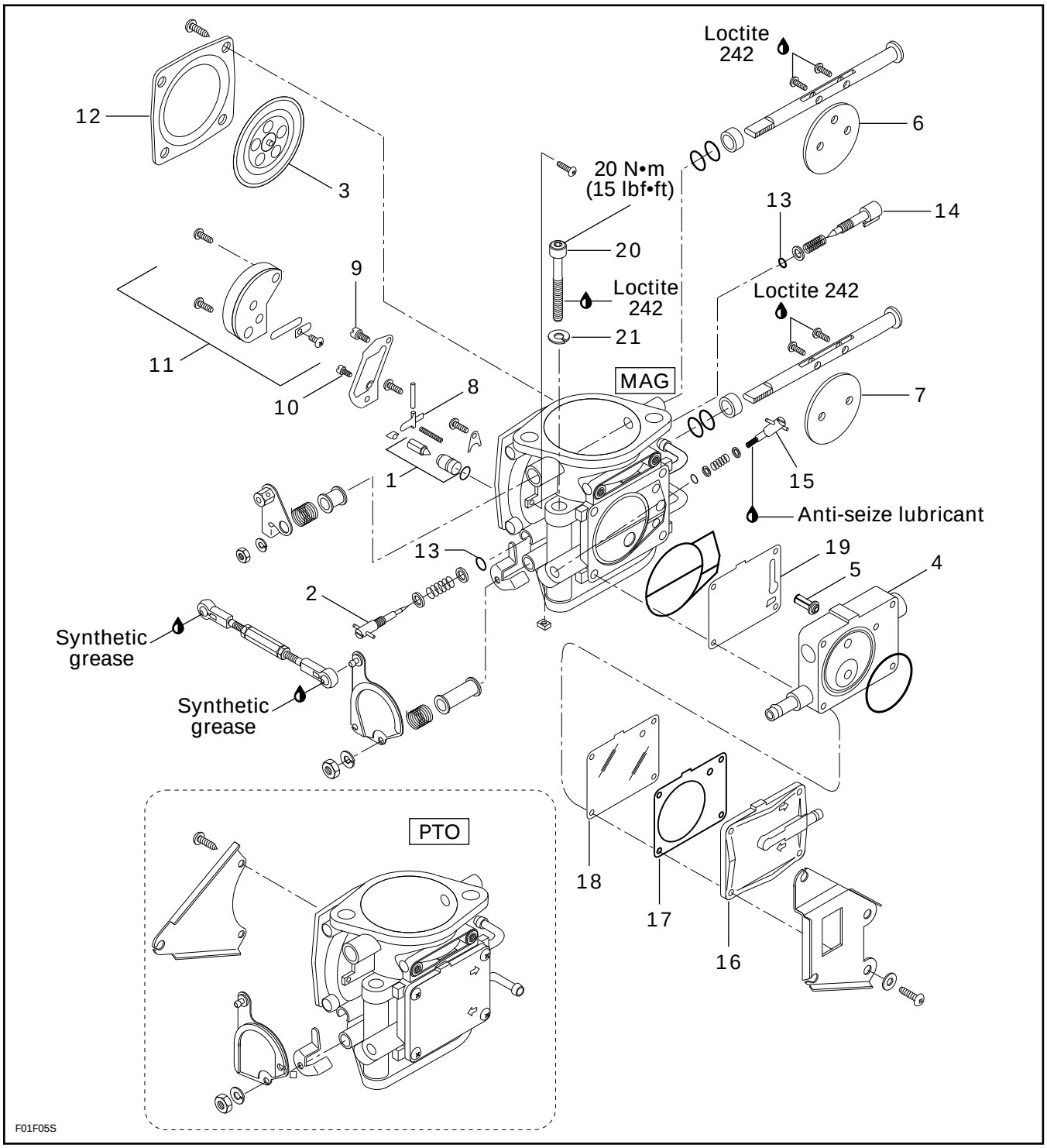
CARBURETORS

587 Engine



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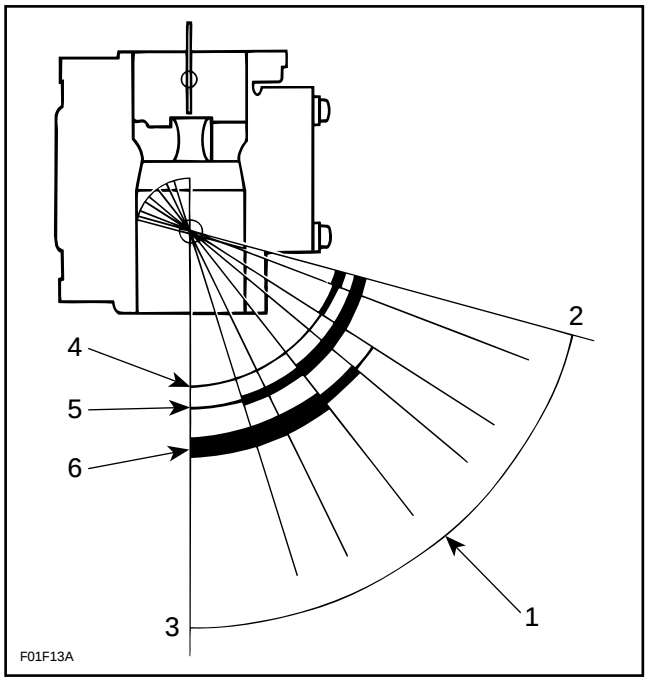
717 and 787 Engines



PARTS
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GENERAL

The following illustration shows which part of the carburetor begins to function at different throttle plate openings.



VIEW FROM AIR INTAKE OPENING

1. *Throttle plate openings*
2. *Throttle plate closed*
3. *Throttle plate wide opened*
4. *Low-speed screw*
5. *Pilot Jet*
6. *Main jet and high-speed screw*

CARBURETOR REMOVAL

To remove carburetors from engine, proceed as followsþ:

Remove air vent tube support (SPþ/þXP series).

Remove air intake silencer. Refer to FUEL SYSTEM 06-02.

Turn fuel valve to OFF position.

Disconnect pulse line from fuel pump.

Disconnect fuel supply line from fuel pump.

Disconnect fuel return line.

Disconnect oil injection pump cable, throttle cable and choke cable.

Twin Carburetor Models Only

16,17, Screw and Lock Washer

Remove screws and lock washers retaining carburetors.

Remove carburetors.

Single Carburetor Models Only

Remove 4 bolts and lock washers from rotary valve cover then move carburetors and rotary valve on top of engine.

NOTE : When removing rotary valve cover, pay attention that the rotary valve will stay in place, otherwise it must be timed.

Remove carburetor from intake manifold.

CLEANING

The entire carburetor should be cleaned with a general solvent and dried with compressed air before disassembly.

CAUTION : Be careful at carburetor cleaning not to remove paint. Paint removal will cause carburetor to rust very rapidly. Repaint if necessary.

Carburetor body and jets should be cleaned in a carburetor cleaner following manufacturer's instruction.

WARNING : Solvent with a low flash point such as gasoline, naphtha, benzol, etc., should not be used as they are flammable and explosive.

CAUTION : Heavy duty carburetor cleaner may be harmful to the rubber parts, O-ring, etc. Therefore, it is recommended to remove those parts prior to cleaning.

Inspect O-rings, diaphragms and gaskets.

DISASSEMBLY AND INSPECTION

Inspect parts for corrosion damage (shaft, throttle plate, spring, screw, check valve housing, etc.).

1, Needle Valve

Inspect needle valve tip for a grooved condition. If worn, needle and seat must be replaced as a matched set.

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2, Low Speed Screw

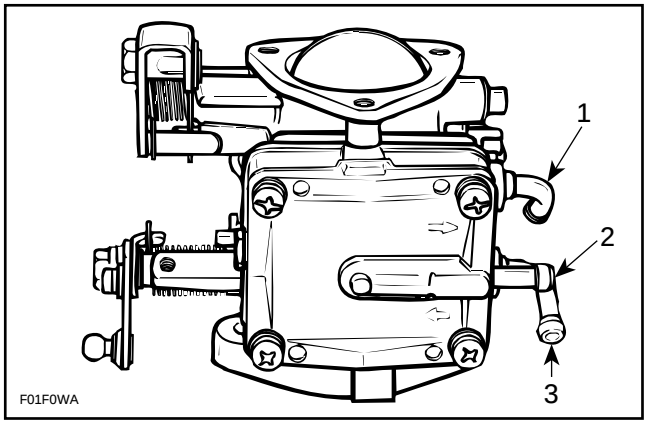
Check tip for a grooved condition. Replace if necessary.

PUMP VERIFICATION

Check fuel pump valves operation as follows :

Connect a clean plastic tubing to the inlet nipple and alternately apply pressure and vacuum with the mouth. The inlet valve should release with pressure and hold under vacuum.

◆ WARNING : Some fuel may be present in fuel pump. Be careful not to swallow fuel when under vacuum.



TYPICAL

1. *Fuel outlet nipple*
2. *Pulse nipple*
3. *Inlet nipple*

Repeat the same procedure at the outlet nipple. This time the outlet valve should hold with pressure and release under vacuum.

3, Diaphragm

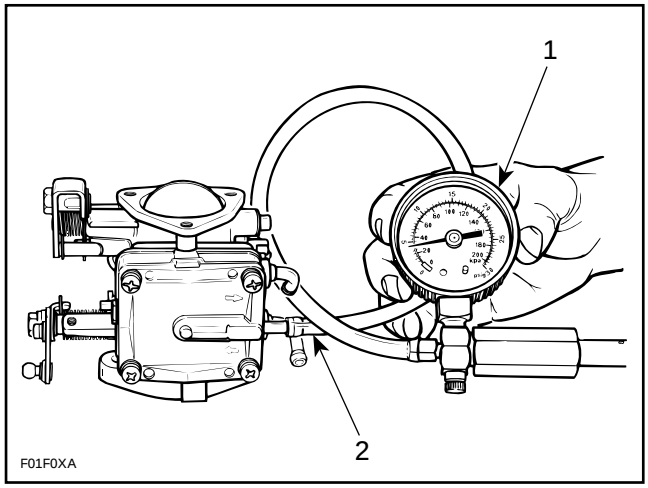
PUMP DIAPHRAGM LEAK TEST

Using a suitable pump gauge tester, perform the following test proceeding as follows :

– Install pump gauge tester (P / N 295 000 114) on pulse nipple.

– Pump tester until it reaches 28 kPa (4 PSI).

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TYPICAL

1. *Pump gauge tester*
2. *Install on pulse nipple*

Diaphragm must stand pressure for 10 seconds. If pressure drops, replace diaphragm.

4, Pump Body

Inspect valves. The pumping area should be free of holes, tears or imperfections. Replace as needed.

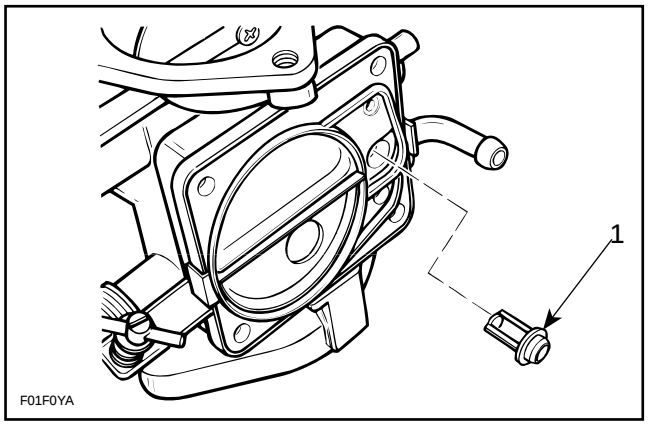
5, Filter

To verify filter condition proceed as followsþ:

Remove pump cover, gasket, diaphragm and then pump body and gasket.

Remove filter from carburetor body then clean filter and blow carefully with compressed air (low pressure).

Replace filter if damaged.



TYPICAL

1. *Filter*

CARBURETOR ASSEMBLY

When assembling pump, ensure to properly position components together. Refer to previous illustrations if necessary.

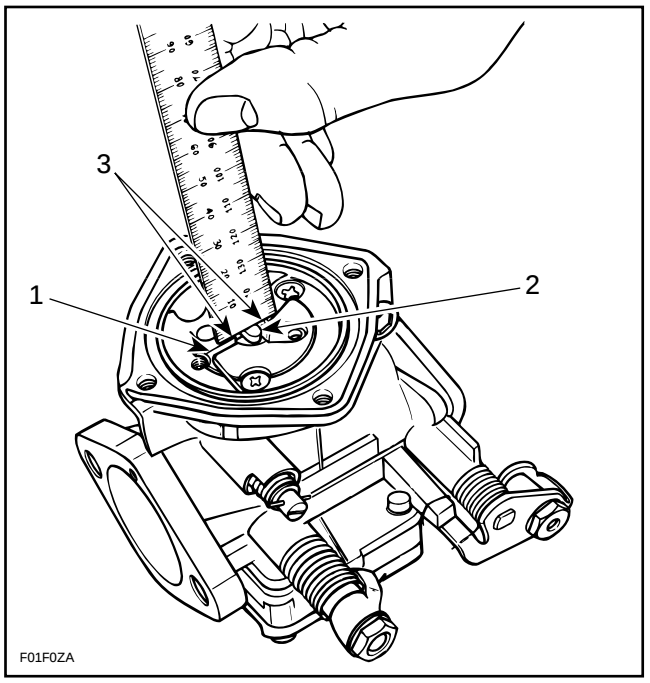
6,7, Choke Plate and Throttle Plate

When installing plate onto shaft, close plate so that it centers into carburetor bore. Firmly tighten screws.

▼CAUTION : Always apply Loctite 242 (blue) on screw threads prior to installing screws.

8, Needle Valve Lever

Rounded end of needle valve lever must be flush with surrounding metering chamber floor and not with body assembly. Place the end of a ruler over lever to check adjustment.

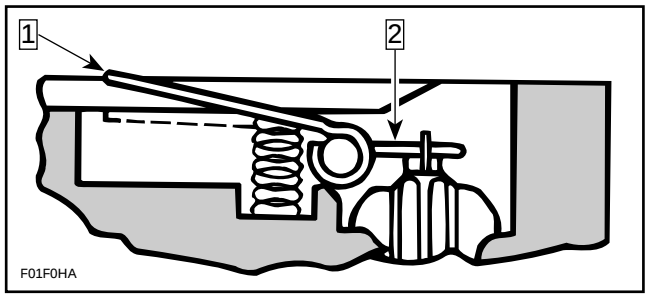


1. *Metering chamber floor*
2. *Lever end*
3. *Flush*

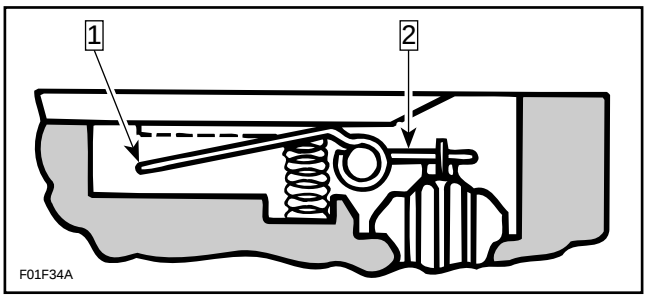
To adjust, bend lever very slightly to change its height.

▼CAUTION : When adjusting lever, do not pry it so that it applies pressure on needle. This could damage valve seat / needle.

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HIGH LEVER
Step 1 depress here
Step 2 push tab down

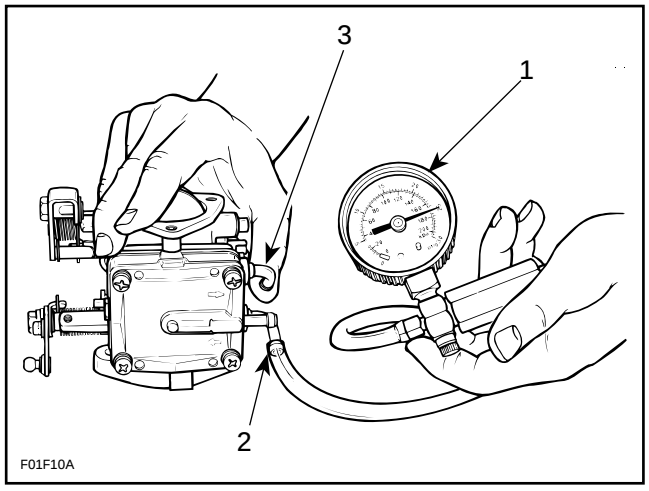


LOW LEVER
Step 1 depress here
Step 2 pry up here

POP OFF PRESSURE TEST

Proceed as followsþ:

– Install pump gauge tester on carburetor inlet nipple.
– Obstruct outlet nipple with a finger.
– Pump tester until inlet release pressure is reached (seen by a sudden pressure drop).



TYPICAL
1. *Pump gauge tester*
2. *Install on inlet nipple*
3. *Obstruct outlet nipple*

Refer to the following table for specifications of the pop off pressure for each model.

MODELS	POP OFF PRESSURE (PSI)	MINIMUM STABILIZED PRESSURE
SP	21-37	14
SPX	40-56	24
SPI	21-37	14
GTS	21-37	14
GTI	40-56	24
XP	27-39	15
HX	40-56	24

NOTE : Pressure test should be performed three times to obtain a valid reading.

If release pressure is not within specification, check control lever adjustment. Replace spring as necessary.

CAUTION : Do not stretch or cut spring.

LEAK TEST

Needle valve must stand a pressure of 69 kPa (10 PSI) for 30 seconds. Otherwise, hold carburetor upside down, pour oil over needle valve and apply pressure.

Check for bubbles. If they come from seat or O-ring, bubbles will exit around seat. Retighten as necessary.

If it still leaks remove needle and seat and replace O-ring.

If bubbles come from needle, replace needle and seat.

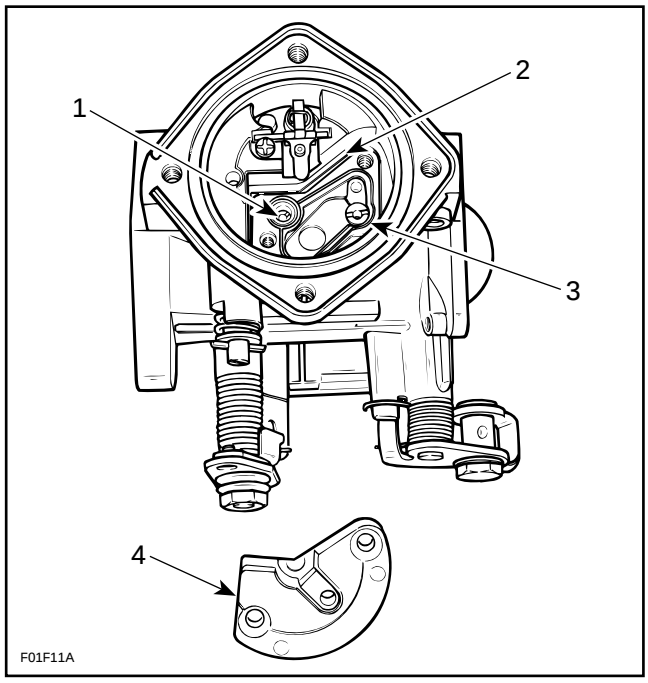
9,10, Main Jet and Pilot Jet

Pilot jet and main jet are replaceable. Different jet sizes are available to suit temperature and altitude conditions. Always inspect spark plug tip condition when dealing with pilot jet and main jet. Spark plug tip condition gives a good indication of carburetor mixture setting.

CAUTION : Adjustments vary with temperature and altitude. Always observe spark plug condition for proper jetting.

NOTE : To have access to pilot jet or main jet, check valve housing must be removed.

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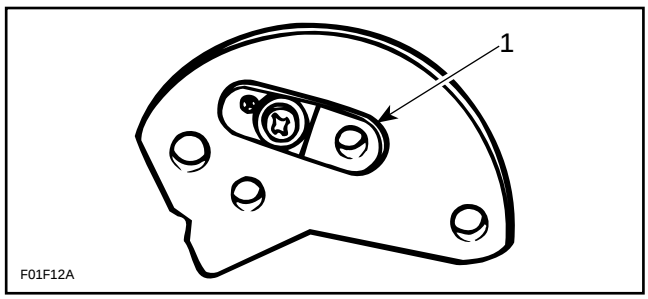
TYPICAL

1. *Pilot jet*
2. *Gasket*
3. *Main jet*
4. *Check valve housing removed*

11, Check Valve Assembly

The check valve is needed if a back pressure occurs into carburetor. It will prevent fuel from flowing back into carburetor lower portion.

Inspect check valve, it should be free of holes, tears or imperfections. Replace as needed.



1. *Check valve*

NOTE : Prior to check valve assembly installation, remember to set gasket.

3,12, Diaphragm and Cover

Install diaphragm with its integrated O-ring into carburetor groove. Make sure that the tab of cover is inserted into carburetor notch.

13, O-ring

When installing O-rings of low speed and high speed screws, apply some BOMBARDIER LUBE (P / N 293 600 016) to prevent sticking.

CARBURETOR INSTALLATION

At installation, pay attention to the following :

Install carburetor(s) with gasket(s) to intake manifold (rotary valve cover for the 787 engine).

Single Carburetor Models Only

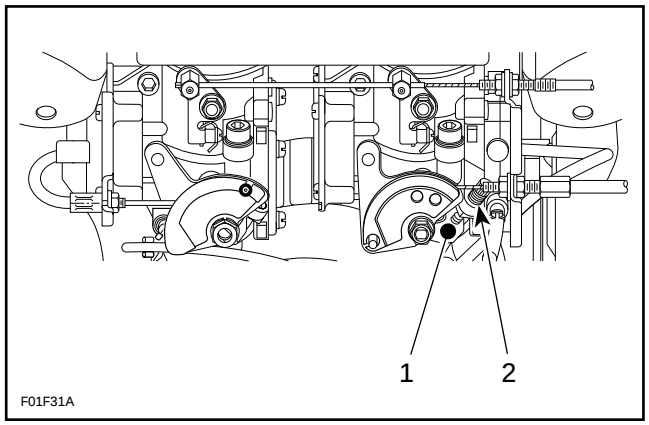
Install lock washers and apply Loctite 242 (blue) on threads then torque nuts to 25 N•m (18 lbf•ft).

Twin Carburetor Models Only

Apply Loctite 242 (blue) on screw threads. Then, install screws with lock washers and torque to 20 N•m (15 lbf•ft).

SYNCHRONIZATION OF TWIN CARBURETORS

With idle speed screw not touching throttle lever stopper on MAG carburetor, both throttle plates are in closed position.

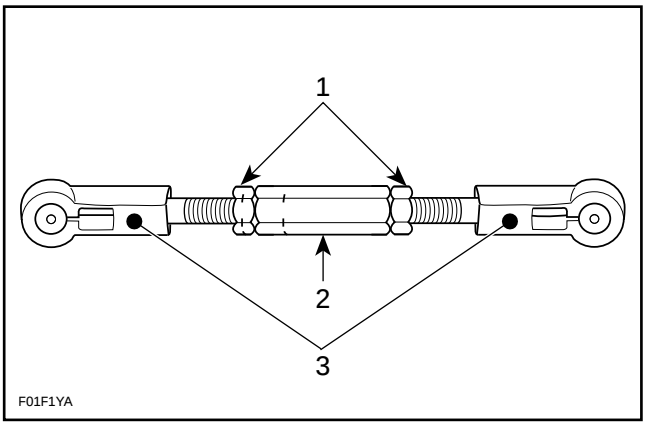


1. *Stopper*
2. *Idle speed screw*

Loosen jam nuts on carburetor linkage and adjust linkage with adjustment nut.

Make sure threads length is the same on each side of linkage and flat surfaces of both ends are parallel with each other.

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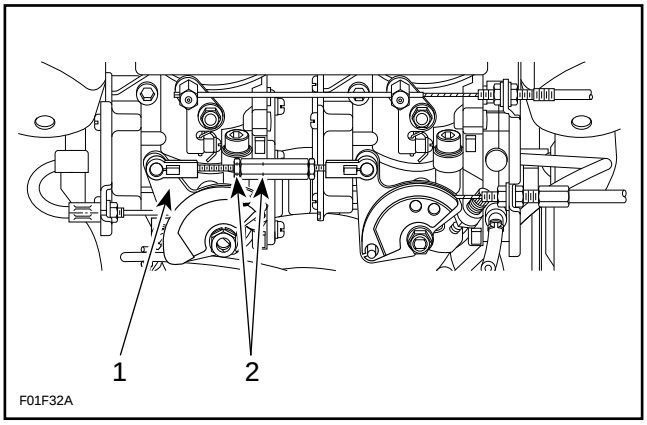
1. Jam nuts
2. Adjustment nut
3. Flat surfaces

Tighten jam nuts and torque to 3 N•m (27 lbf•in).

NOTE : Grease carburetor linkage at both ends with synthetic grease (P / N 293 550 010).

Connect linkage between both carburetor levers. Ensure both throttle plates are still in closed position.

NOTE : The linkage installation is done with the marks located near PTO carburetor throttle lever to ease adjustment if to be performed in the watercraft.



1. Throttle lever PTO side
2. Marks

CAUTION : Throttle plates must open simultaneously, otherwise this will cause engine to vibrate and / or back fire.

Fuel Lines and Hose Clamps

If fuel line ends are damaged, cut damaged end before reinstallation.

Properly install clamps.

WARNING : Make sure there is no leak in fuel system.

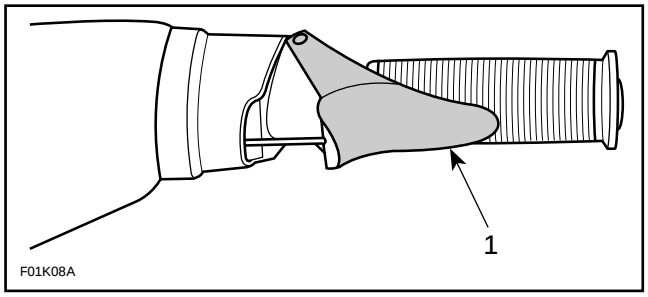
For fuel system pressurization, refer to FUEL SYSTEM 06-01.

ADJUSTMENTS

Throttle Cable

Lubricate cable with BOMBARDIER LUBE lubricant.

Throttle lever must reach handlebar grip without causing strain to cable or carburetor cable bracket.

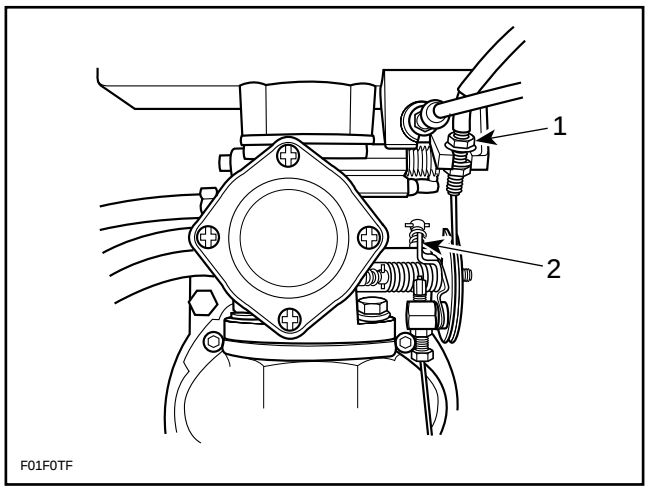


1. Must touch handlebar grip

Ensure carburetor throttle plate is fully open at full throttle position. At this position throttle lever stopper is almost in contact (0.5 mm (1/64 in)) with carburetor body.

CAUTION : Improper cable adjustment will cause strain on cable and / or damage cable bracket or throttle lever at handlebar.

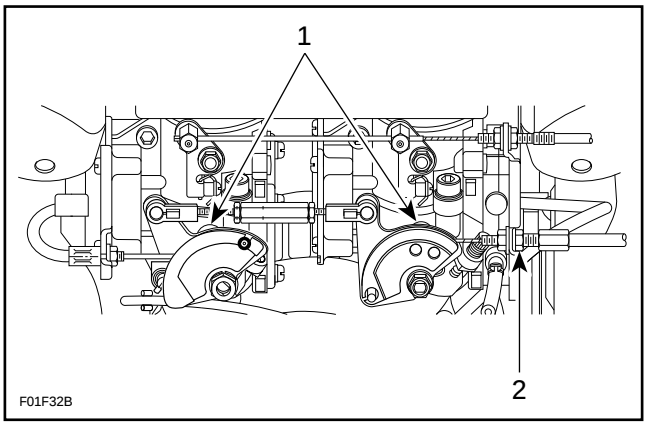
To adjust, loosen jam nut then turn adjustment nut as necessary.



587 ENGINE

1. Adjustment nut
2. Throttle lever stopper

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717 AND 787 ENGINES

1. *Throttle lever stoppers (behind levers)*
2. *Adjustment nut*

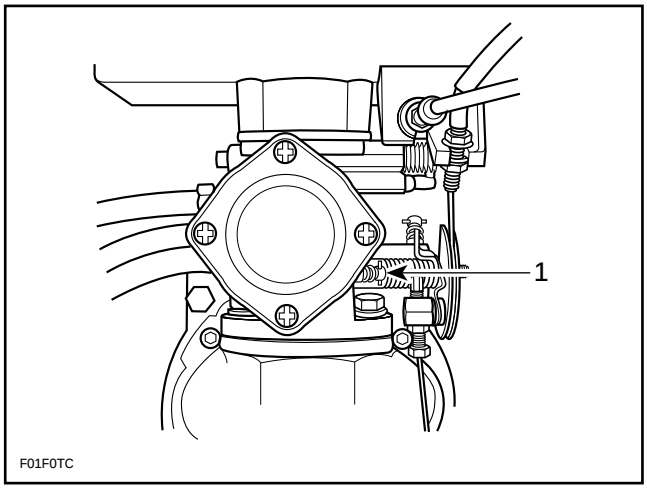
Tighten jam nut and recheck adjustment.

◆ WARNING : Make sure idle speed screw contacts stopper when throttle lever is fully released at handlebar.

After throttle cable adjustment, always proceed with oil injection pump adjustment. Refer to LUBRICATION SYSTEM 07-02.

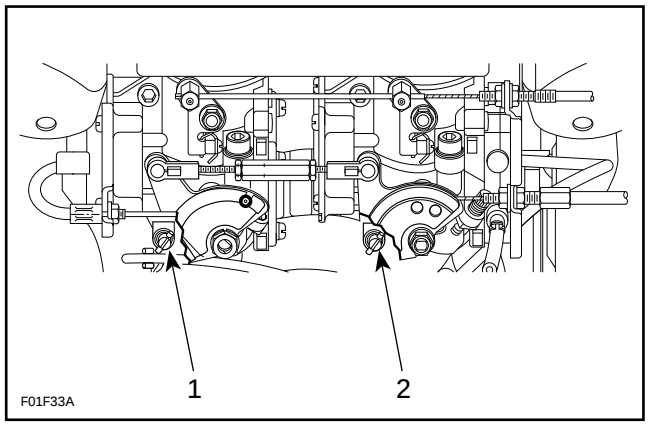
▼ CAUTION : Improper oil injection pump synchronization with carburetor can cause serious engine damage.

2, Low Speed Screw



587 ENGINE

1. *Low speed screw*



717 AND 787 ENGINES

1. *Low speed screw (PTO)*
2. *Low speed screw (MAG)*

▼ CAUTION : Do not attempt to set engine idle speed with low-speed screw.

Tighten low speed screw until a slight resistance is felt. Then, back it off to the specification as per following chart.

Watercraft model	SP	SPX	SPI	XP	HX	GTS	GTI
Low speed screw (turn)	1-1/4	1-1/4	1-1/4	1	1-3/4	1-1/4	1-1/4

○ NOTE : Turning screw clockwise leans mixture and turning screw counterclockwise enriches mixture.

Start and warm up engine.

▼ CAUTION : Water must be supplied to cool engine.

Check that engine idles and runs smoothly. Make sure engine reacts quickly to throttle lever depression. If necessary, readjust low speed screw (±þ1/4 turn).

○ NOTE : On twin carburetor engines both low speed screws must be adjusted exactly the same way. Never adjust screws more than 1/4 turn at a time.

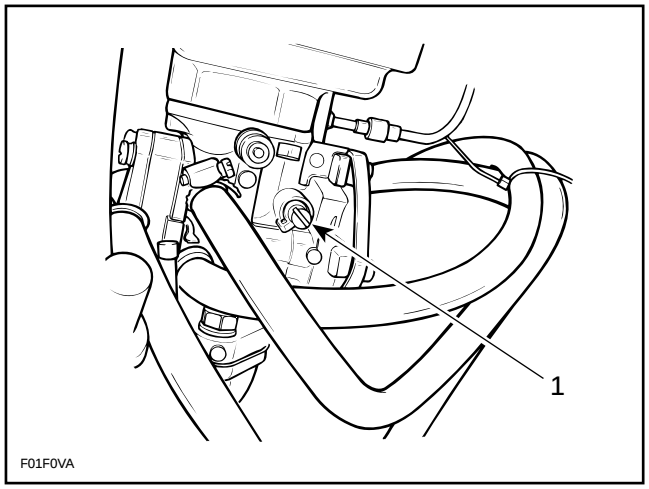
14, High Speed Screw

The high speed screw is sealed with a plastic cap that allows an adjustment of 1/4 turn.

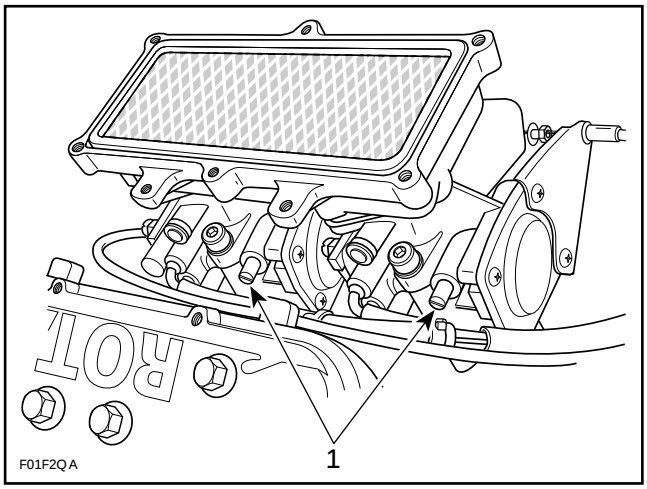
○ NOTE : Turning screw 1/4 turn counterclockwise enriches mixture and turning screw clockwise leans mixture.

▼ CAUTION : Do not attempt to adjust high speed screw by removing plastic cap.

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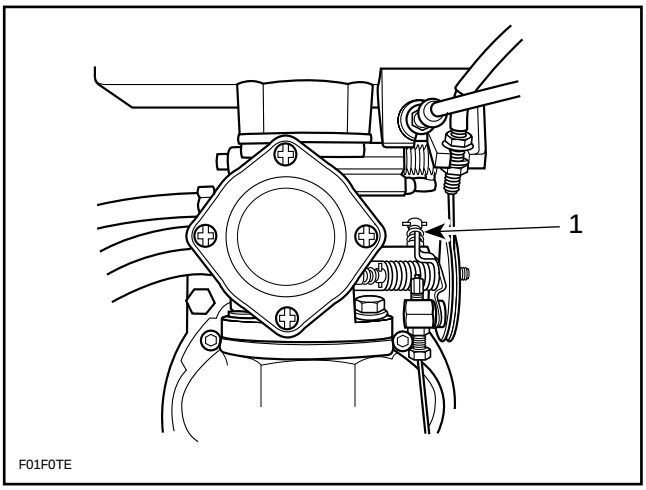
TYPICAL - 587 ENGINE
1. High speed screw



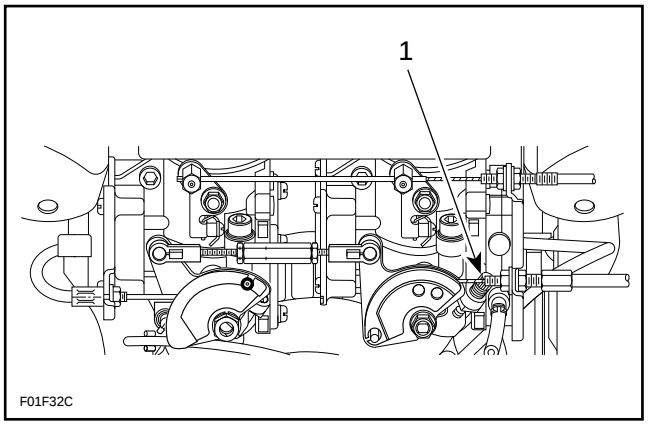
TYPICAL - 717 AND 787 ENGINES
1. High speed screws

15, Idle Speed Screw

Turning screw clockwise increases engine idle speed and turning screw counterclockwise decreases engine idle speed.



587 ENGINE
1. Idle speed screw



717 AND 787 ENGINES
1. Idle speed screw

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NOTE : On twin carburetor engines, there is only one idle speed screw.

Connect an induction-type tachometer (P / N 295 000 100) on spark plug cable of magneto side to measure engine speed.

NOTE : To adjust idle speed, ensure flame arrester and air intake silencer are installed.

Start engine and bring to normal operating temperature.

CAUTION : If watercraft is out of water, water must be supplied to cool engine.

Turn screw so that engine idles at 1500 RPM if watercraft is in water.

If watercraft is out of water, refer to the following chart to adjust idle speed to the specification.

Watercraft model	Idle speed out of water (RPM)
SP	2400
SPX	3000
SPI	2500
XP	3000
HX	3000
GTS	2500
GTI	3000

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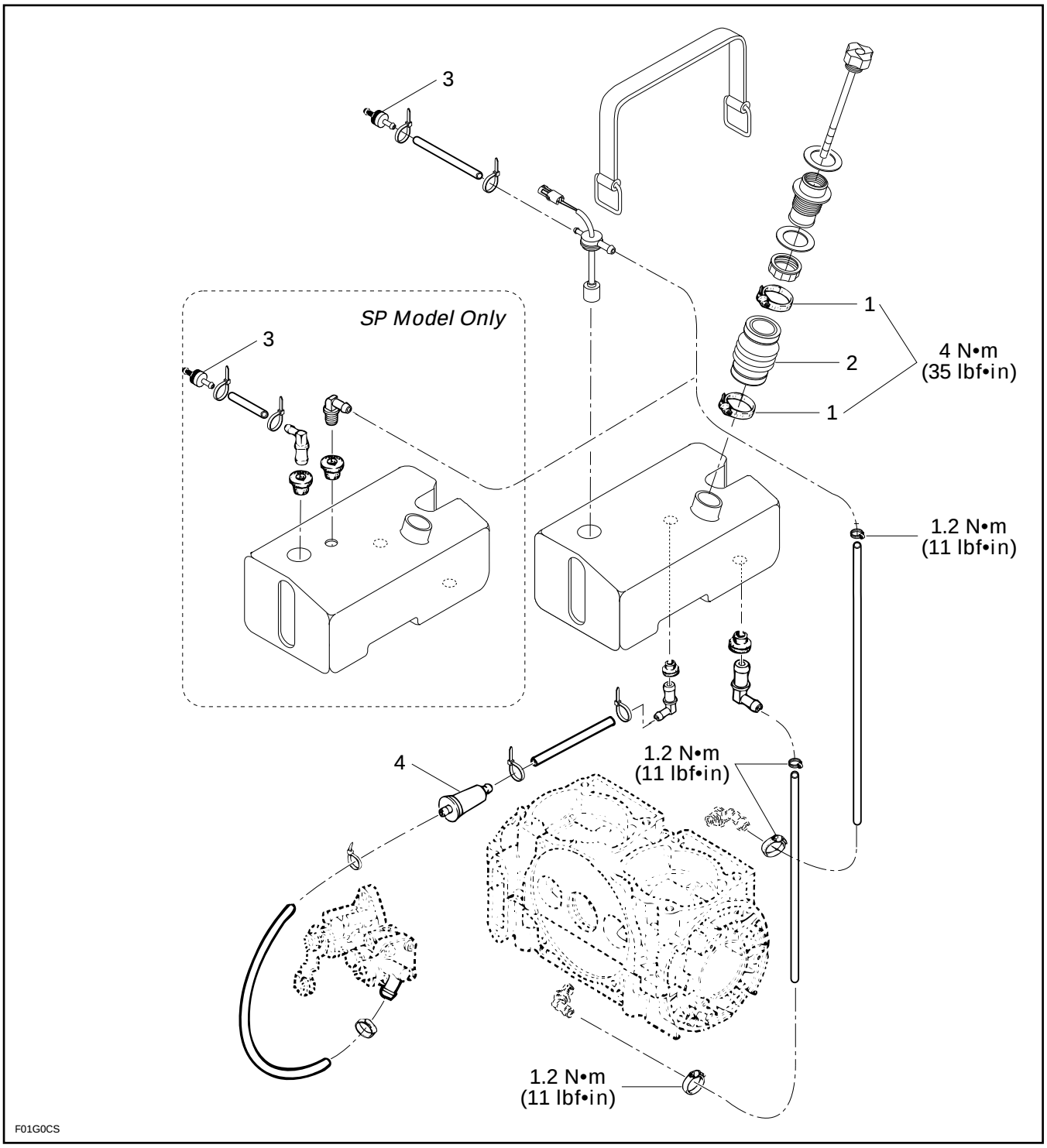
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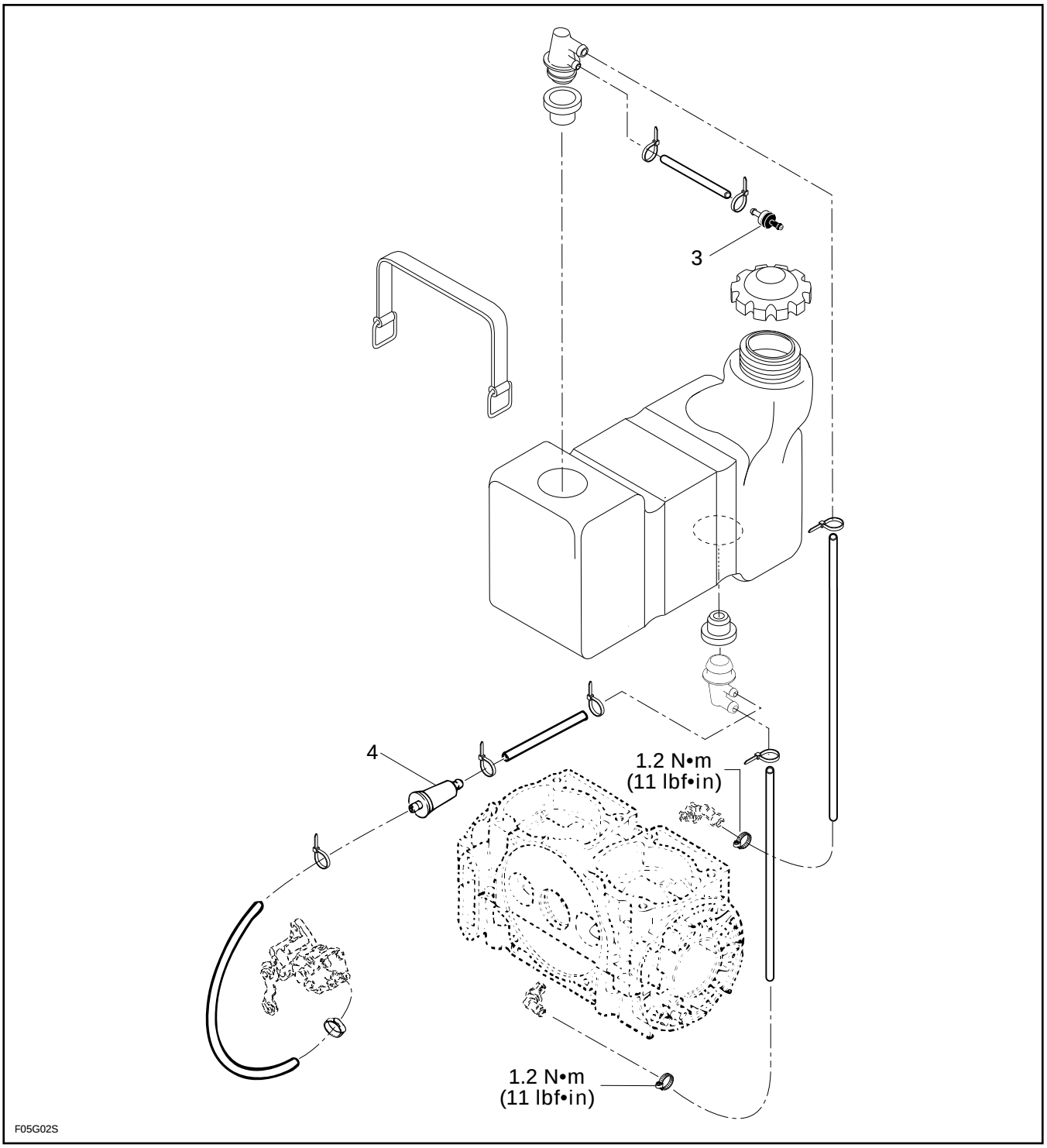
OIL INJECTION SYSTEM

All Models Except HX



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HX Model



PARTS
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GENERAL

Whenever repairing the oil injection system, always verify for water infiltration in reservoir.

Perform also a pressure test of the oil injection system.

1,2, Clamp and Hose

Verify oil filler neck hose for damage. Always ensure that clamps are well positioned and tightened. Torque clamps to 3 N•m (27 lbf•in).

3, Check Valve

Black side of the one-way check valve is the valve outlet. It allows air to get in reservoir.

4, Oil Filter

Oil filter should be replaced annually.

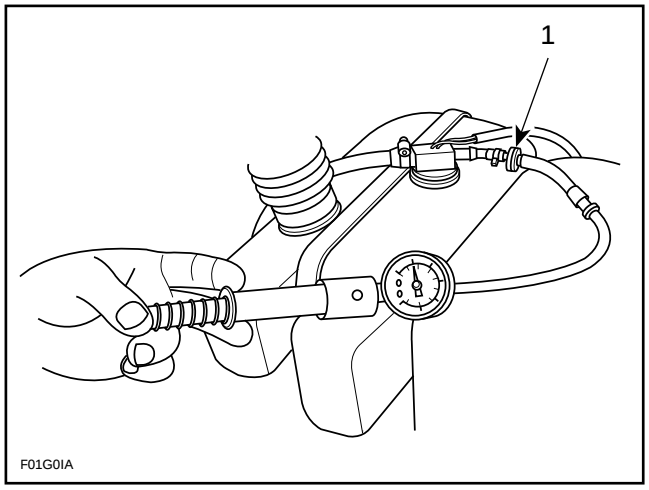
OIL SYSTEM PRESSURIZATION

◆ WARNING : Whenever oil system components are disconnected or replaced, a pressure test must be done before starting engine. Ensure to verify oil line ends for damage. Always cut damaged end before reinstallation.

Pressure Test

Proceed as follows :

– Fill up oil reservoir.
– Install a hose pincher to rotary valve shaft oil supply hose.
– Install a hose pincher to rotary valve shaft oil return hose.
– Install a hose pincher to oil injection pump supply hose.
– Connect pump gauge tester to check valve of oil injection reservoir vent.



TYPICAL

1. Connect pump to check valve

– Pressurize oil system to 21 kPa (3 PSI). If pressure is not maintained, locate leak and repair / replace component leaking. To ease leak search spray a solution of soapy water on components, bubbles will indicate leak location.

○ NOTE : The system must maintain a pressure of 21 kPa (3 PSI) for at least 10 minutes. Never pressurize over 21 kPa (3 PSI).

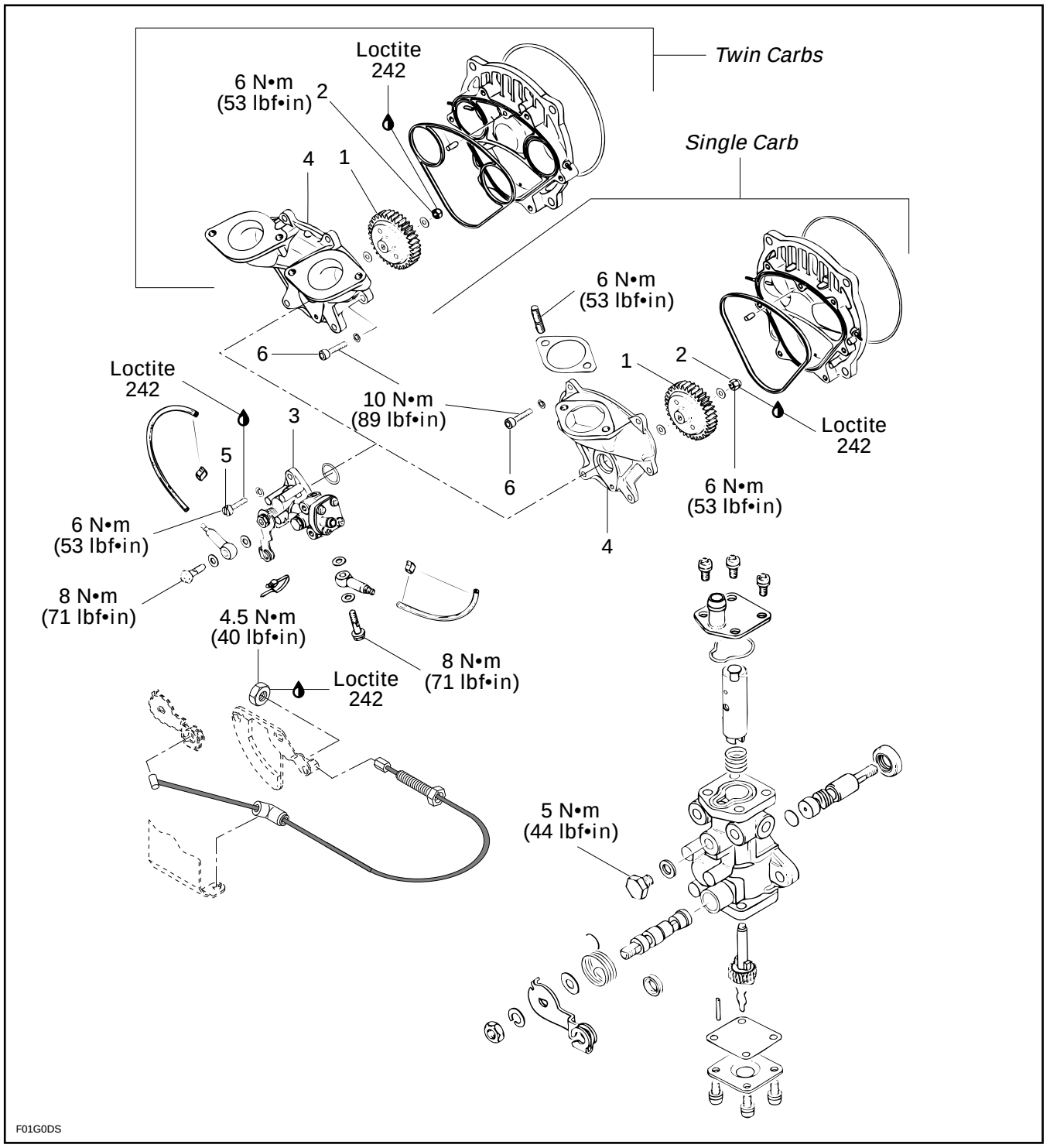
▼ CAUTION : If any leak is found, do not start the engine and wipe off any oil leakage.

– Disconnect pump gauge tester and remove hose pinchers.

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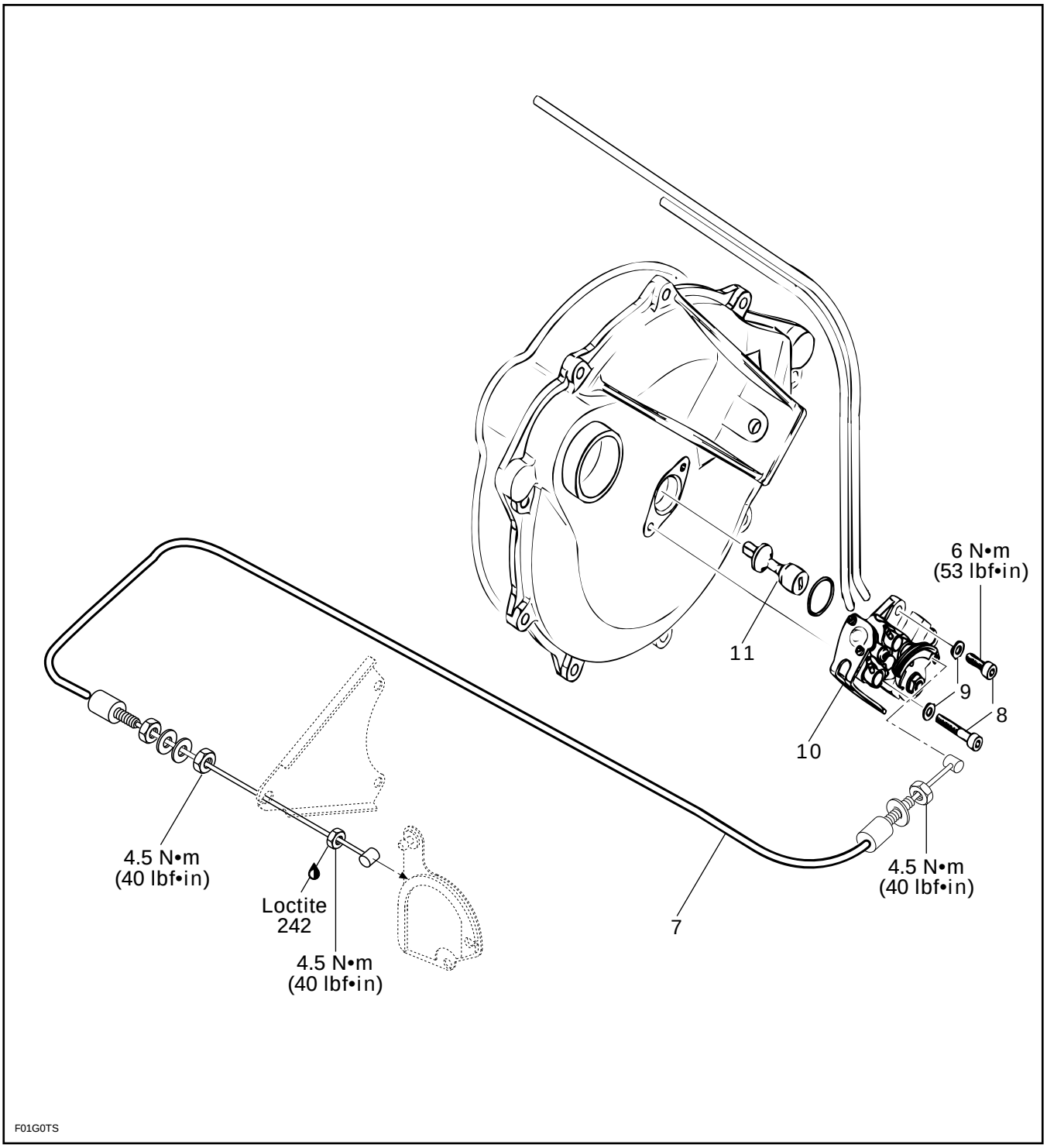
OIL INJECTION PUMP

All Models Except XP



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XP Model



PARTS
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REMOVAL

All Models Except XP

Remove air intake silencer (refer to FUEL SYSTEM 06-02).

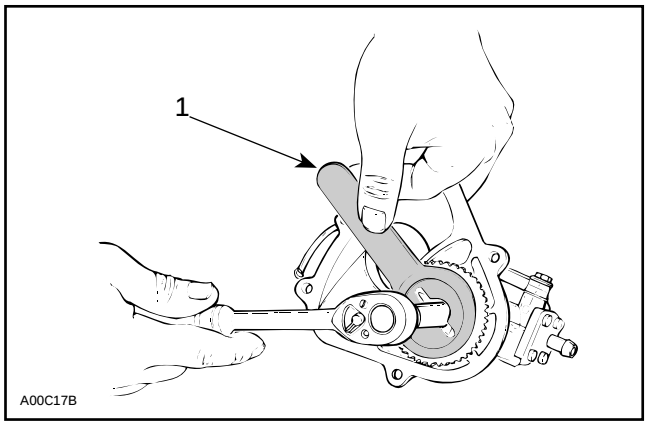
Remove rotary valve cover (refer to ENGINE 04-05).

Remove 6 Allen screws retaining intake manifold to rotary valve cover.

Separate intake manifold from rotary valve cover.

1,2, Oil Pump Gear and Lock Nut

To separate oil pump from intake manifold, remove oil pump gear using gear holder (P / N 290 277 905) and unscrew lock nut.



1. Gear holder

XP Model Only

7,8,9, Cable, Screw and Flat Washer

Disconnect oil injection pump cable.

Remove 2 Allen screws with flat washers retaining oil injection pump to ignition housing cover.

10,11, Pump and Shaft

Pull pump and shaft.

Disconnect oil hoses from fittings of oil injection pump.

DISASSEMBLY

NOTE : Some oil pump parts are not available in single parts.

A gasket set is available for the pump.

If the pump is found defective, it should be replaced by a new one.

CLEANING

Discard all seals and O-rings. Clean metal components in a solvent.

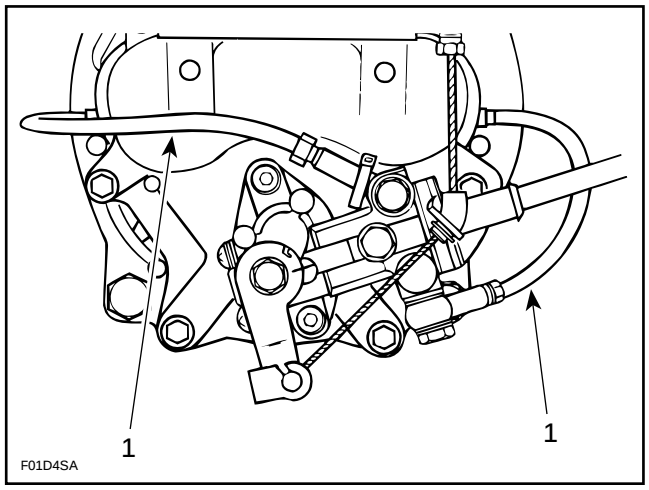
ASSEMBLY

All Models Except XP

3,4,5, Oil Injection Pump, Intake Manifold and Screw

Install oil injection pump to intake manifold. Torque screws to 6 N•m (53 lbf•in).

CAUTION : Whenever oil injection lines are removed, always make the routing as shown.



1. Small oil line

1,2, Oil Pump Gear and Lock Nut

Install gear to oil injection pump shaft. Torque lock nut to 6 N•m (53 lbf•in).

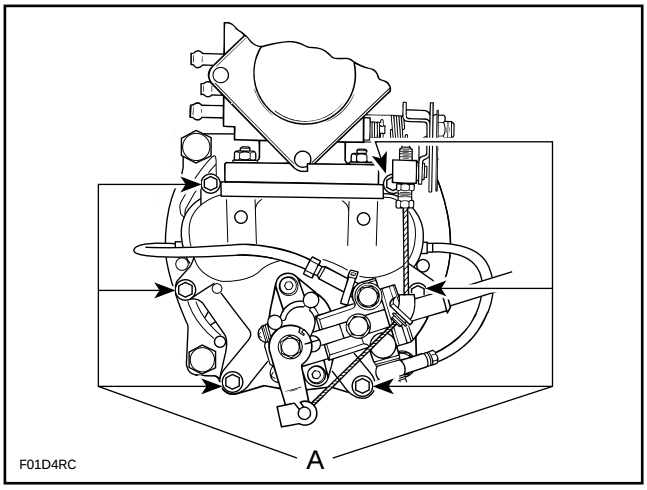
NOTE : Make sure one washer is installed on each side of gear.

4,6, Intake Manifold and Screw

Install intake manifold to rotary valve cover and torque screw to 10 N•m (89 lbf•in).

NOTE : Make sure a new gasket is installed to rotary valve cover.

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TYPICAL
A. 10 N•m (89 lbf•in)

XP Model Only

8,9,10,11, Screw, Flat Washer, Pump and Shaft

Install shaft in crankshaft end.

Install pump. Secure with flat washers and screws. Torque to 3 N•m (26 lbf•in).

Install oil injection pump cable.

ADJUSTMENTS

▼ CAUTION : As oil injection pump adjustment is dependant on throttle cable position, make sure to perform throttle cable adjustment first.

Preliminary Synchronization

○ NOTE : To check synchronization of pump as a routine maintenance, refer to Final Synchronization. Make sure idle speed of engine is properly adjusted.

Ensure carburetor butterfly(ies) is (are) in closed position.

○ NOTE : On a twin carburetor engine, make sure carburetors are properly synchronized. If necessary, refer to FUEL SYSTEM 06-03.

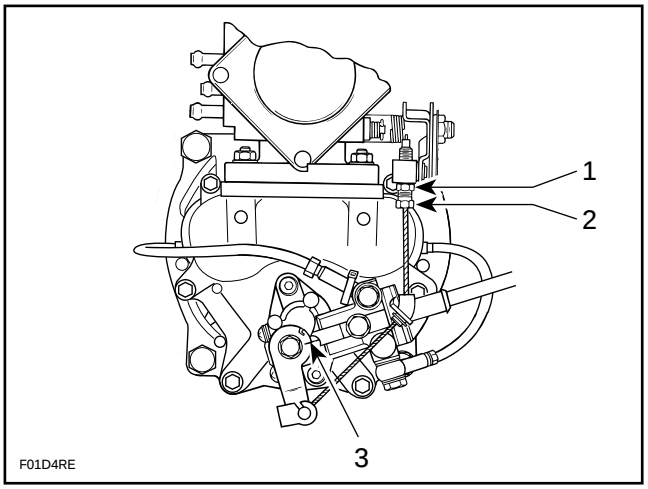
Turn idle speed screw until it contacts stopper.

Turn idle speed screw 2 turns.

Turn cable adjustment nut to align marks on pump.

○ NOTE : A mirror may be used to facilitate this verification.

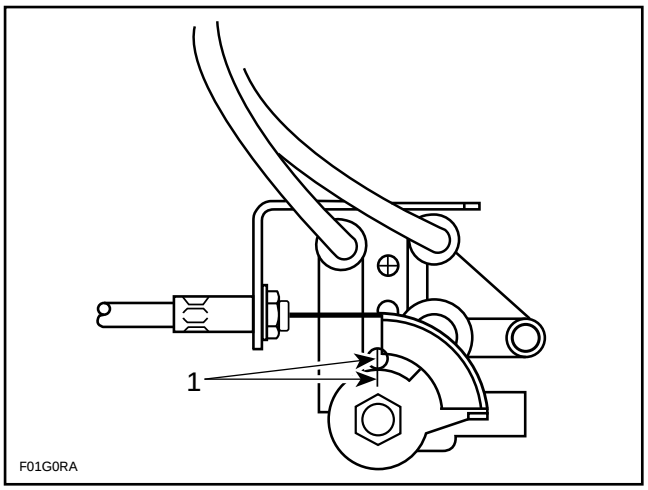
587 and 717 Engines



TYPICAL
1. Jam nut
2. Adjustment nut
3. Aligned marks

787 Engine

○ NOTE : The adjustment screw and jam nut for the oil injection pump cable is located at PTO carburetor lever.



1. Aligned marks

All Engines

Start and bring engine to normal operating temperature.

▼ CAUTION : Water must be supplied to cool engine.

Adjust idle speed to specification. Refer to FUEL SYSTEM 06-03.

Stop engine.

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Final Synchronization

Eliminate throttle cable free-play by depressing throttle lever until a slight resistance is felt. In this position, marks on pump body and lever must align.

NOTE : A mirror may be used to facilitate this verification.

If necessary, turn cable adjustment screw to obtain pump mark alignment. Refer to above illustrations.

Tighten jam nut and recheck alignment marks.

CAUTION : Proper oil injection pump adjustment is very important. Any delay in the opening of pump can result in serious engine damage.

Bleeding

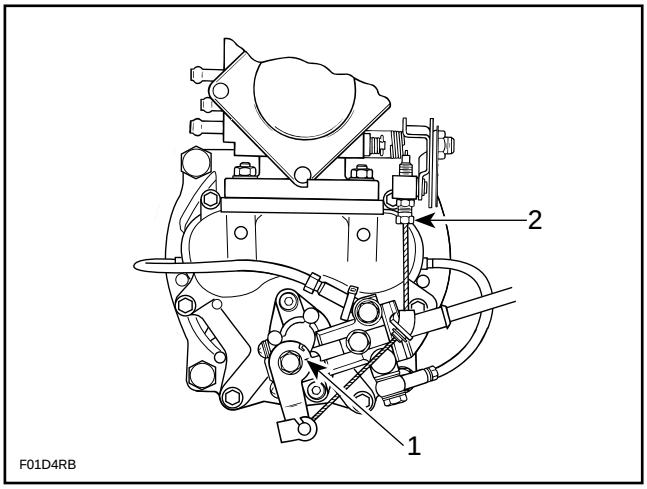
CAUTION : Oil injection system must be bled and adjustment checked before operating engine.

Ensure oil injection reservoir is sufficiently filled.

Install a dry rag below oil injection pump.

Loosen bleed screw to allow oil to flow.

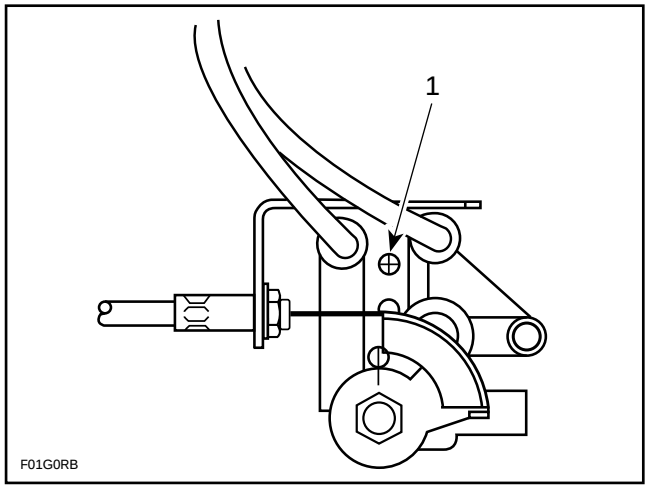
587 and 717 Engines



TYPICAL

1. Bleed screw

787 Engine



1. Bleed screw

All Engines

Keep bleeding until all air has escaped from line. Make sure no air bubbles remain in oil supply line.

Tighten bleed screw.

Wipe any oil spillage.

Check small oil lines between pump and intake manifold. They must be full of oil.

If not, run engine at idle speed while manually holding pump lever in fully open position. Do not activate throttle lever.

CAUTION : Water must be supplied to cool engine.

CHECKING OPERATION

On Watercraft

NOTE : Oil line supply must be full of oil. See bleeding procedure above.

Start engine and run at idle while holding the pump lever in fully open position. Oil must advance into small oil lines.

NOTE : The engine should have a rich mixture, idling irregularly and emitting a lot of smoke from exhaust outlet.

If not, remove pump assembly and check the pump gear (587 and 717 engines) or shaft (787 engine) for defects, replace as necessary. Test pump as describes below :

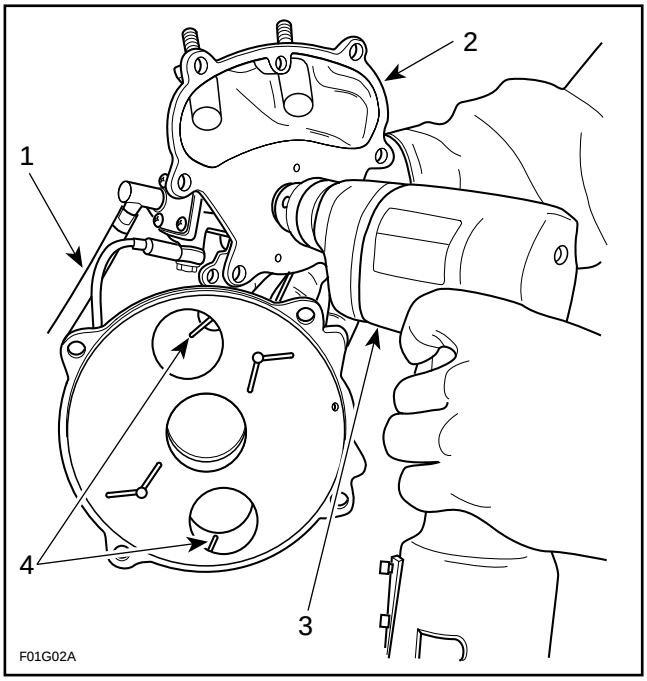
NOTE : Through normal use, oil level must not drop in small tubes. If oil drops, verify check valve operation. Replace as necessary.

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Bench Test

The oil pump must be removed out of watercraft.

Connect a hose filled with injection oil to main line fitting. Insert other hose end in an injection oil container. Using a counterclockwise (reverse position) rotating drill rotate pump shaft. Oil must drip from fittings in parts of rotary valve cover while holding lever in a fully open position.



TYPICAL

1. *Supply oil line to an oil container*
2. *Hold lever in fully open position*
3. *Counterclockwise (reverse) rotating drill*
4. *Oil must drip here*

For an accurate test, each port should be checked separately to ensure equal delivery on both ports.

To obtain a precise result of the oil pump delivery rate, rotate it counterclockwise at 1500 RPM for a total time of 30 seconds.

NOTE : To ensure accuracy of test, oil lines should be completely filled before starting test.

Compare the results with the chart below. If oil pump is out of specification, replace it.

Engine	587	717	787
Oil Pump Flow Rate at 1500 RPM (30 seconds)	0.83 - 1.00 mL (each port)	1.24 - 1.51 mL (each port)	0.71 - 0.87ml (each port)

NOTE : Test can also be done at 3000 RPM. Double quantities in chart.

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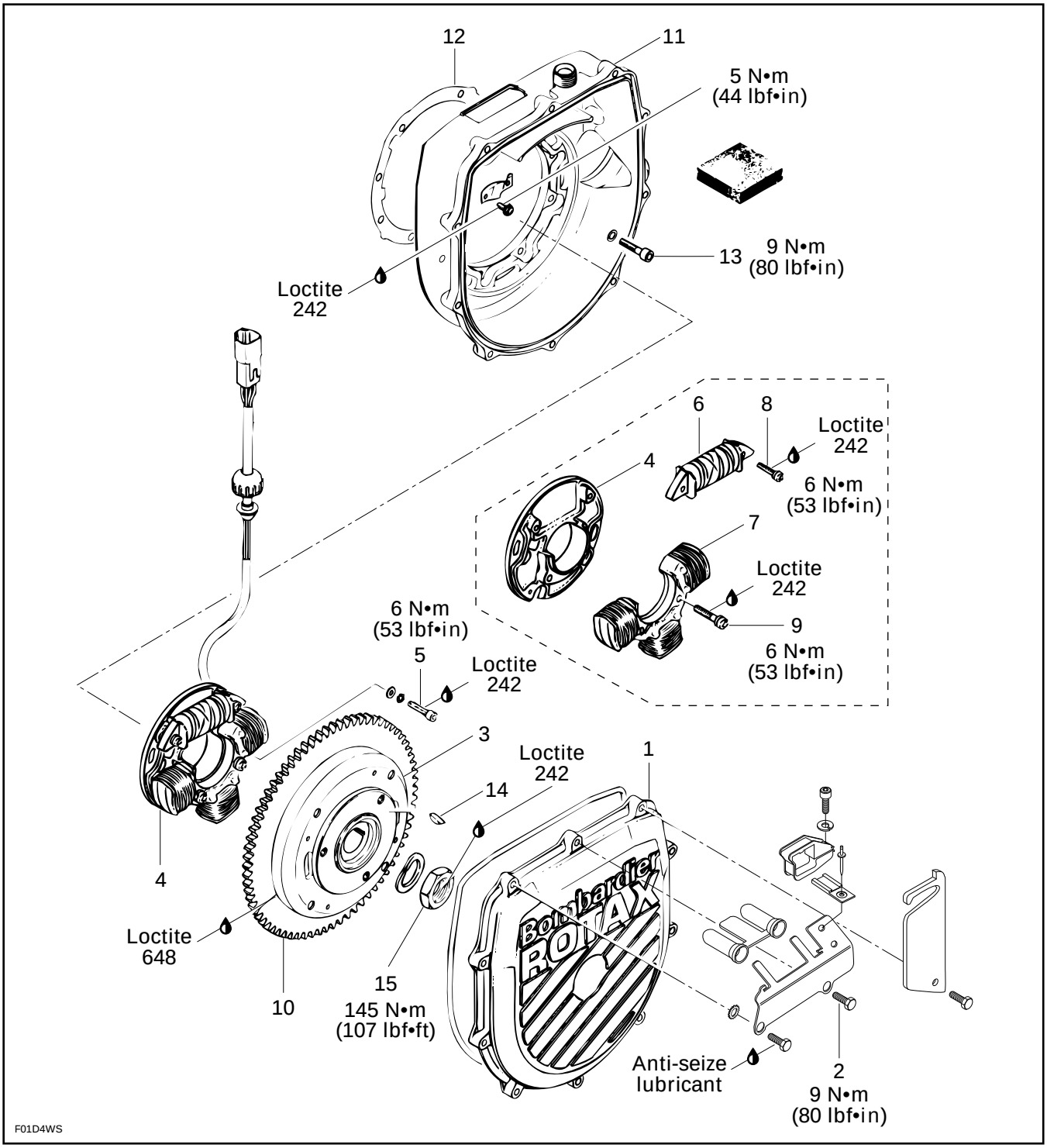
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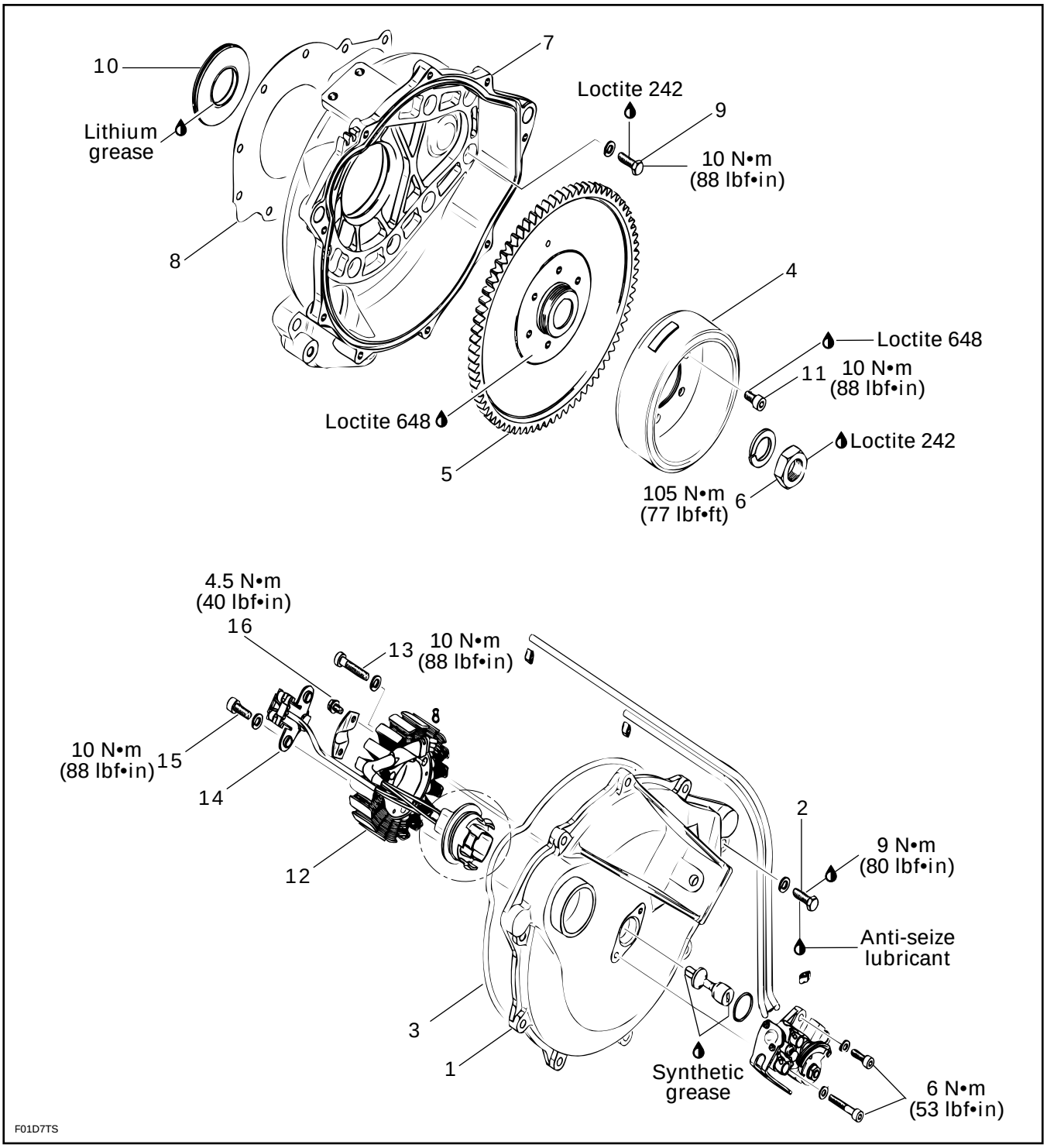
MAGNETO SYSTEM

587 and 717 Engines



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787 Engine



PARTS
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GENERAL

The following procedures can be performed without removing engine from watercraft. However, battery removal will be required (except for the XP and HX).

REMOVAL

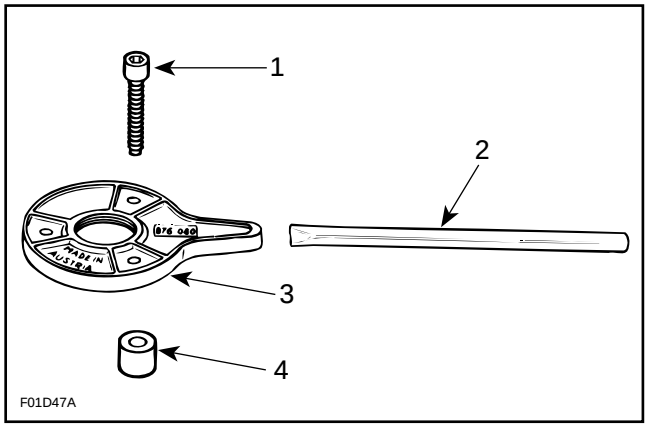
587 and 717 Engines

1,2, Magneto Housing Cover and Screw

Remove screws, wire support and spark plug grounding device then withdraw cover.

3,10, MAG Flywheel and Ring Gear

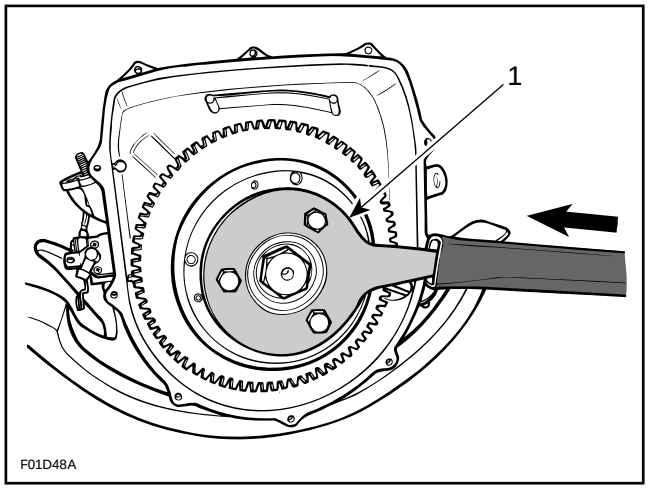
MAG flywheel is locked with puller plate (P / N 290 876 080), sleeves (P / N 290 847 220) and extension handle (P / N 295 000 111).



1. Screw
2. Extension handle
3. Puller plate
4. Sleeve

Using 3 M8 x 35 screws (P / N 290 841 591), install screws through puller plate and slide sleeves on screws then secure puller plate on MAG flywheel so that sleeves are against flywheel.

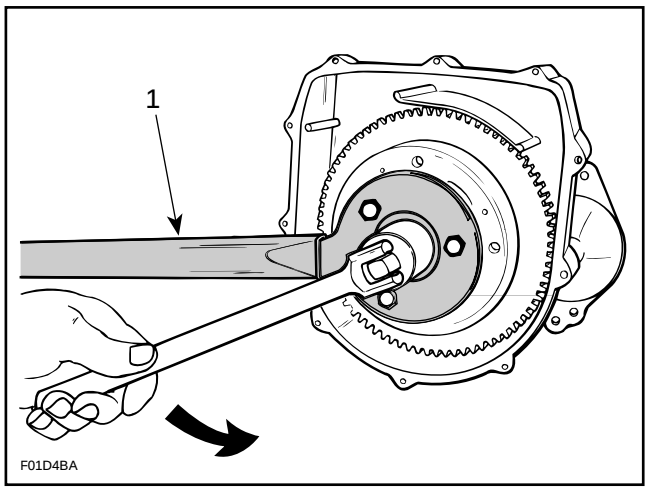
Install extension handle on end of puller plate.



TYPICAL
1. Sleeves on opposite side

Using a suitable socket, unscrew retaining nut COUNTERCLOCKWISE when facing it.

NOTE : If socket is found too large to be inserted in puller plate, machine or grind its outside diameter as necessary.

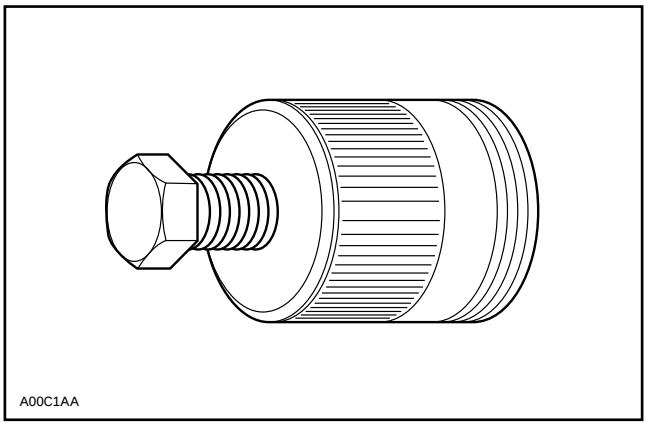


TYPICAL
1. Extension handle locking crankshaft

Remove nut and lock washer from MAG flywheel.

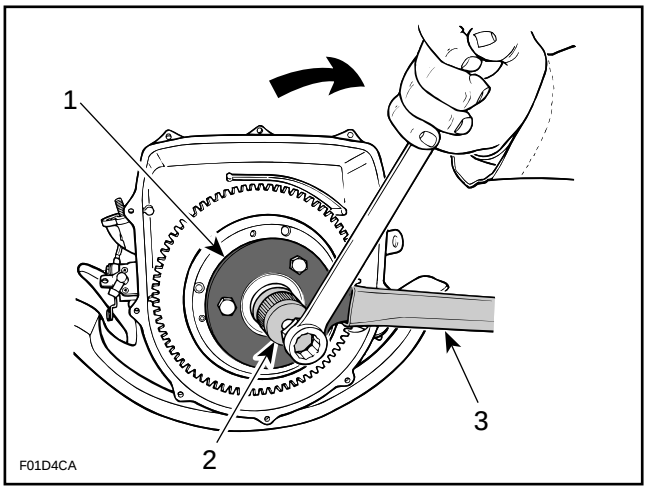
MAG flywheel is easily freed from crankshaft with puller (P / N 295 000 106).

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Fully thread on puller in puller plate.

Tighten puller bolt and at the same time, tap on bolt head using a hammer to release MAG flywheel from its taper.



1. Puller plate
2. Puller
3. Extension handle

4,5, Armature Plate and Screw

Remove 3 retaining screws and withdraw armature plate.

11,13, Magneto Housing and Screw

To remove magneto housing, starter has to be removed. Refer to ELECTRICAL SYSTEM 08-04.

Unscrew retaining screw, then withdraw housing.

Engine Crankcase Replacement

587 and 717 Engines

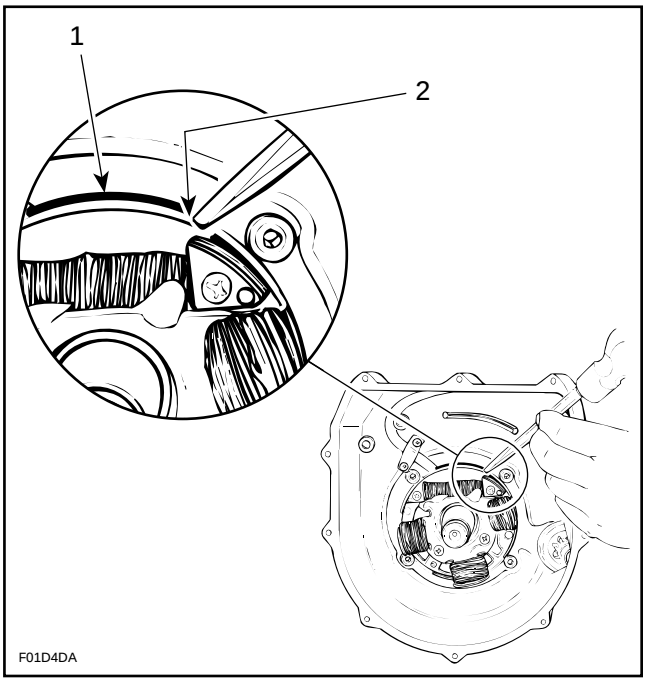
Since replacement crankcases do not have timing mark for armature plate location, indexing marks should be made on armature plate and crankcase to ease reassembly and further ignition timing.

The following procedure is to find a common reference point on both crankcases (old and new) to position armature plate.

Proceed as follows :

– Find a crankcase locating lug (the top one in this example).

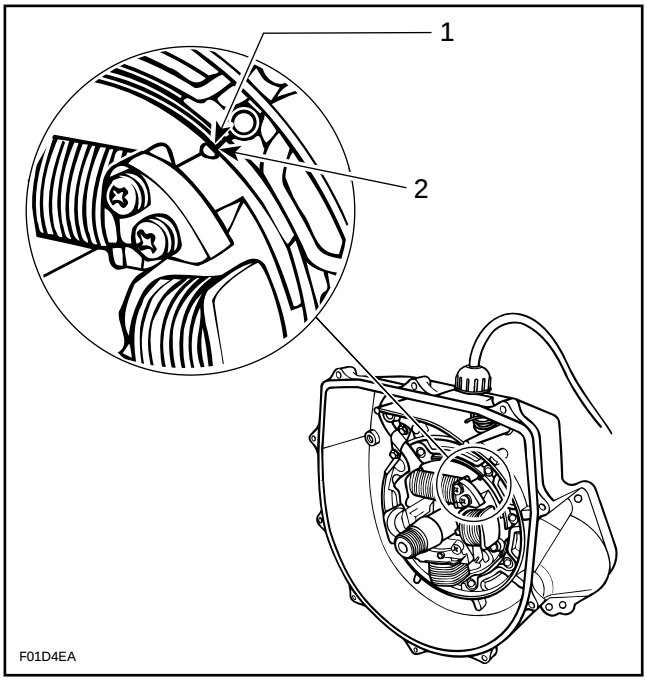
– Place a cold chisel at the end of choosen lug, then punch a mark on armature plate at this point.



1. Crankcase locating lug
2. Mark armature plate at the end of lug

– At assembly, align armature plate mark (previously punched) with the end of the same locating lug on the new crankcase.

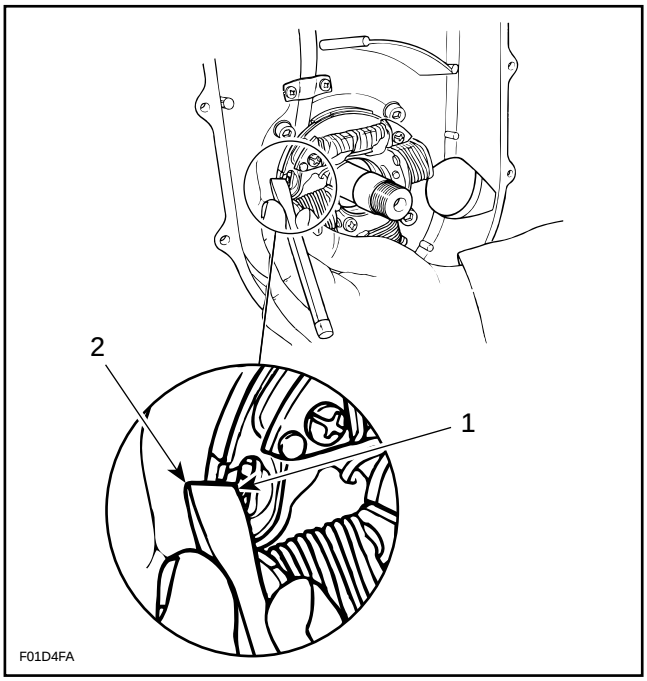
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TYPICAL

1. *Lug end of crankcase*
2. *Align mark and lug end here*

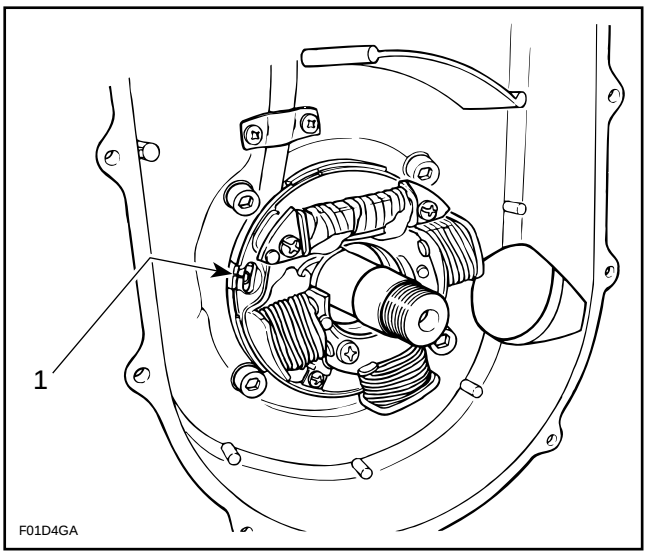
– Find manufacturer's mark on armature plate. In line with this mark, punch another mark on adjacent crankcase lug.



TYPICAL

1. *Manufacturer's mark on armature plate*
2. *Punch a mark on crankcase lug aligned with plate mark*

The new mark on crankcase will be used for further assembly positioning as a pre-timing position.



TYPICAL

1. *For further assembly, use these marks*

787 Engine

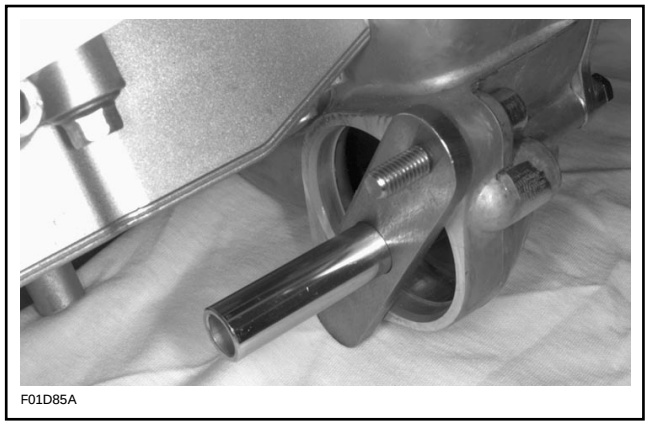
1,2, Magneto Housing Cover and Screw

Remove engine magneto cover.

15,16, Rotor and Flywheel

Remove starter.

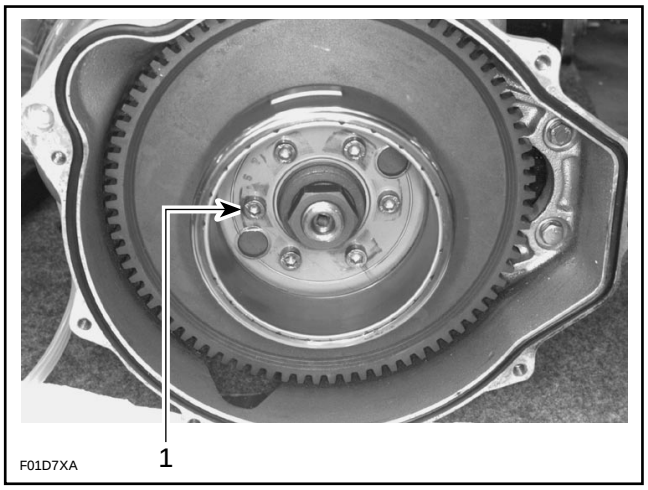
Lock ring gear using special tool (P / N 295 000 134).



1. *Ring gear blocking tool*

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If desired, magneto rotor can be removed without the engine flywheel. Remove the 6 screws.



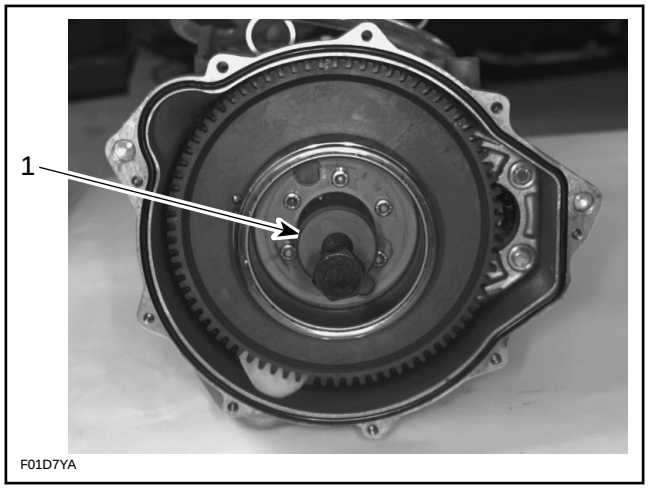
1. Screw

Using a suitable socket, unscrew retaining nut of engine flywheel COUNTERCLOCKWISE when facing it.

Remove special tool locking ring gear.

Engine flywheel is easily freed from crankshaft with puller (P / N 420 976 235) and crankshaft protective cap (P / N 290 876 557).

Insert crankshaft protector to outer end of crankshaft and fully thread puller in engine flywheel.



1. Puller

Tighten puller screw and at the same time, tap on screw head using a hammer to release engine flywheel from its taper.

CLEANING

Clean all metal components in a solvent.

▼ CAUTION : Clean coils and magnets using only a clean cloth.

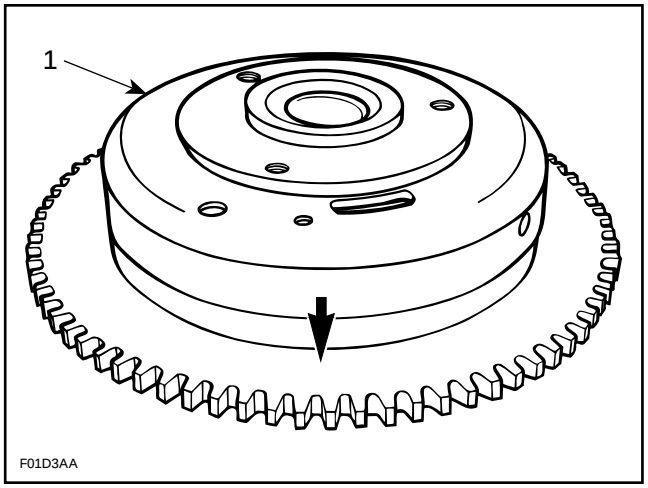
Clean crankshaft taper and threads.

DISASSEMBLY

587 and 717 Engines

3,10, MAG Flywheel and Ring Gear

Lay MAG flywheel on a steel plate. Tap lightly on ring gear using a hammer to release it from MAG flywheel.

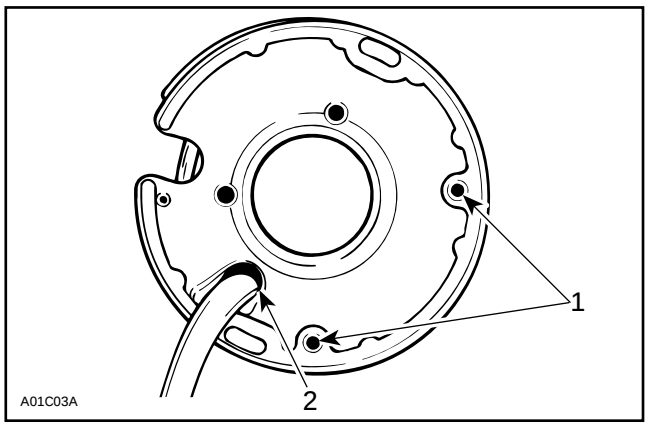


1. Magneto flywheel

6, Generating Coil

To replace generating coil :

– Heat the armature plate to 93°C (200°F) around the screw holes to break the threadlocker bond.

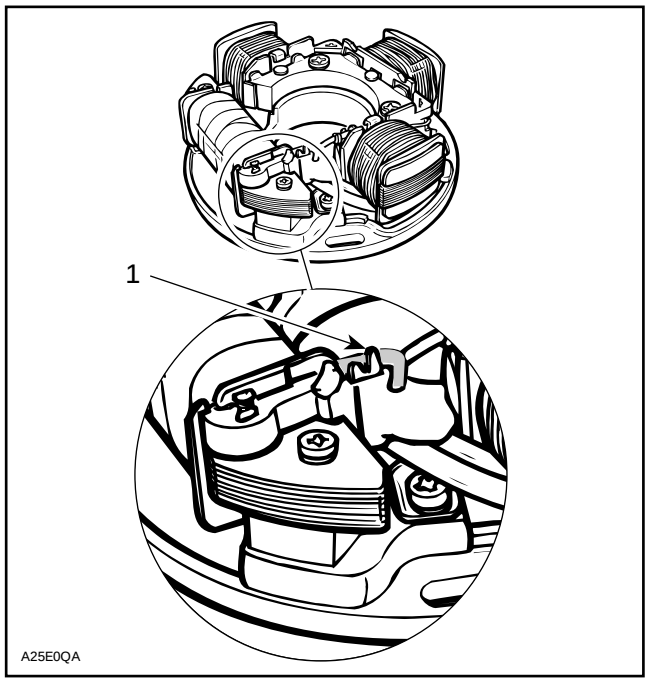


1. Heat the armature plate

▼ CAUTION : Protect harness from flame.

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– Remove screws.
– Uncrimp and unsolder BLACK / RED wire from coil.

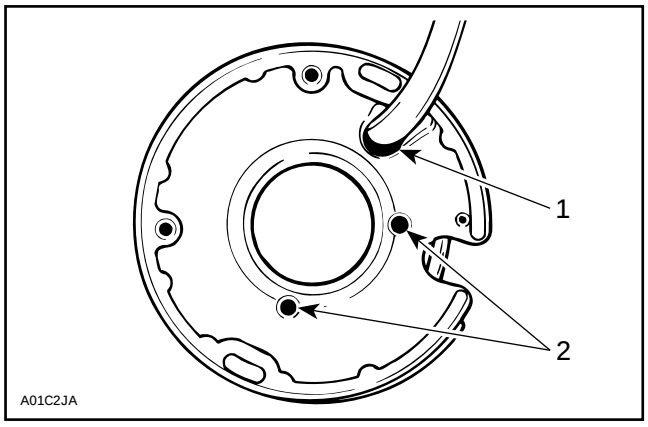


1. Uncrimp and unsolder wire here

7, Battery Charging Coil

To replace battery charging coil :

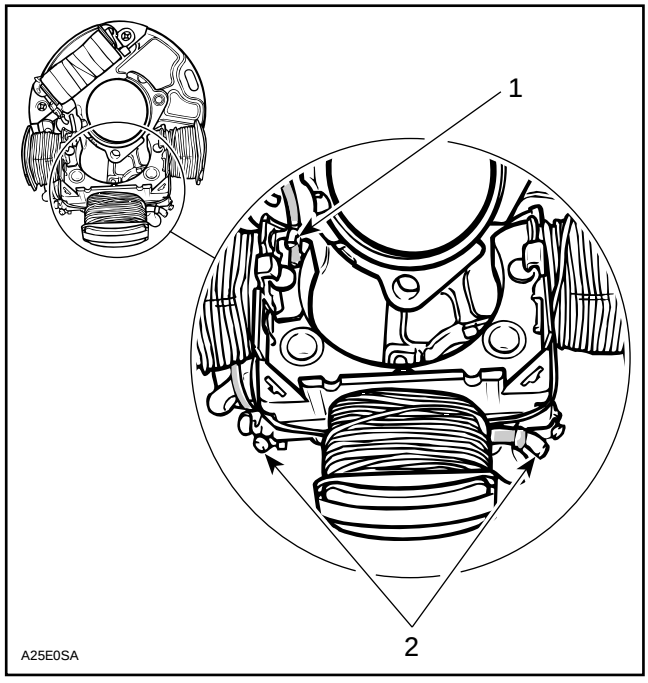
– Heat the armature plate to 93°C (200°F) around the screw holes to break the threadlocker bond.



1. Heat the armature plate

▼ CAUTION : Protect harness from flame.

– Remove screws.
– Uncrimp and unsolder YELLOW and YELLOW / BLACK wires from coil.
– Uncrimp and unsolder ground wire (BLACK) from coil core.



1. .Uncrimp and unsolder ground wire (BLACK) here
2. Uncrimp and unsolder YELLOW and YELLOW / BLACK wires here

ASSEMBLY

587 and 717 Engines

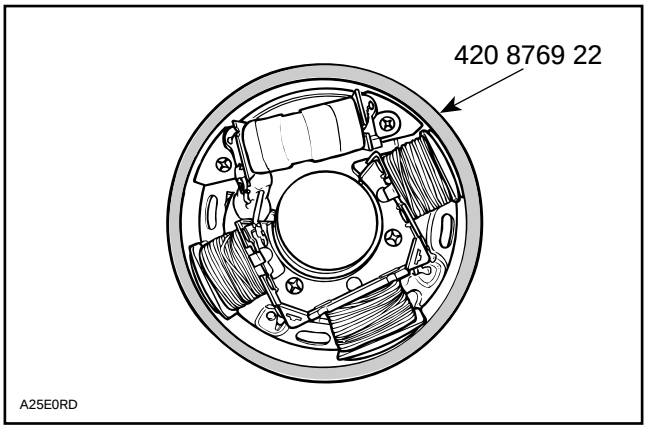
6,8, Generating Coil and Screw

Strip end of old wire then crimp and solder on new coil.

Apply Loctite 242 (blue) to screws and install the new coil on armature plate.

Use magneto coil centering tool (P / N 290 876 922) and install so that it fits around armature plate before tightening screws.

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1. Magneto coil centering tool (P / N 290 876 922)

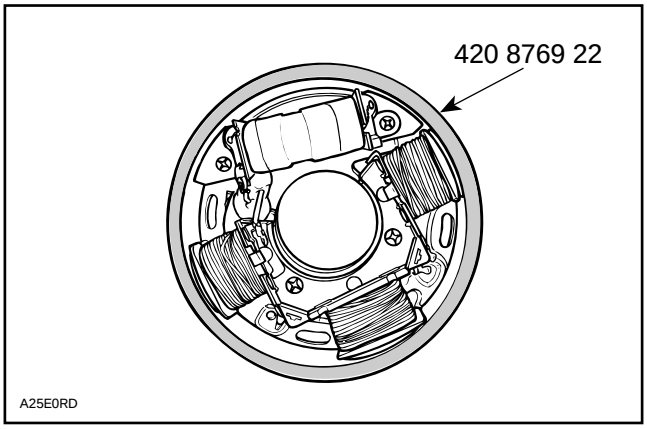
▼CAUTION : Before reinstalling the magneto, remove the loose epoxy from harness.

7,9, Battery Charging Coil and Screw

Position new coil, crimp and solder all wires.

Prior to assembly, apply Loctite 242 (blue).

Use magneto coil centering tool (P / N 290 876 922) and install it so that it fits around armature plate before tightening screws.

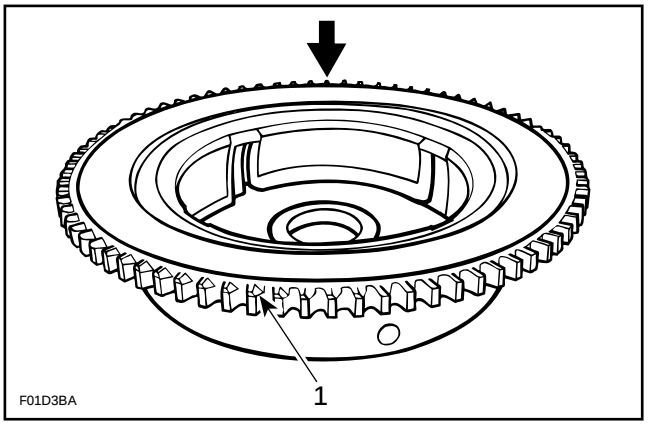


1. Magneto coil centering tool (P / N 290 876 922)

3,10, MAG Flywheel and Ring Gear

Apply Loctite 648 (green) to MAG flywheel mating surface. Lay ring gear on a steel plate, then heat with a propane torch in order to install it on MAG flywheel.

Pay particular attention to position ring gear teeth chamfer side as per following illustration.



1. Teeth chamfer

○ NOTE : Ensure that ring gear contacts MAG flywheel flange.

Whenever replacing either ring gear or MAG flywheel, Gun Kote must be applied to prevent possible corrosion.

▼CAUTION : Always assemble MAG flywheel and ring gear prior to apply Gun Kote. If not done correctly, ring gear won't contact MAG flywheel flange.

To apply Gun Kote proceed as follows :

1. Clean thoroughly and degrease replacement part using a non oil base solvent.
2. Apply coating in light thin coats using a spray gun.

○ NOTE : Do not spray Gun Kote into MAG flywheel threaded holes.

3. Bake parts in oven at 175° (350°F) for one hour to cure Gun Kote.

▼CAUTION : Do not eliminate Gun Kote heat curing time because it will lose all its resistance and it will not give any protection.

▼CAUTION : At installation of magneto, ring gear teeth chamfer and starter clutch should be facing each other.

INSTALLATION

587 and 717 Engines

11,12,13, Magneto Housing, Gasket and Screw

Install gasket between magneto housing and engine crankcase.

Install magneto housing and torque screws to 9 N•m (80 lbf•in).

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4,5, Armature Plate and Screw

Position the armature plate on the crankcase, aligning the marks on both parts.

Apply a drop of Loctite 242 (blue) on screw threads and torque to 6 N•m (53 lbf•in).

3,14,15, Magneto Flywheel, Woodruff Key and Nut

Apply Loctite 242 (blue) on crankshaft taper.

Position Woodruff key and magneto flywheel. Apply Loctite 242 (blue) on nut threads. Install nut with lock washer and torque to 145 N•m (107 lbf•ft).

▼ CAUTION : Never use any type of impact wrench at magneto installation.

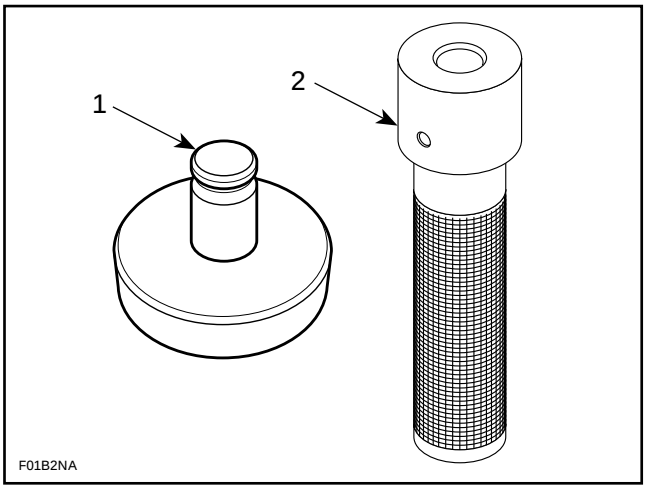
Ignition Timing

For procedures, refer to ELECTRICAL SYSTEM 08-02.

787 Engine

11,18, Magneto Housing and Seal

To install oil seal of magneto housing, use pusher (P / N 290 877 740) and handle (P / N 290 877 650).



1. Pusher
2. Handle



11,12,13, Magneto Housing, Gasket and Screw

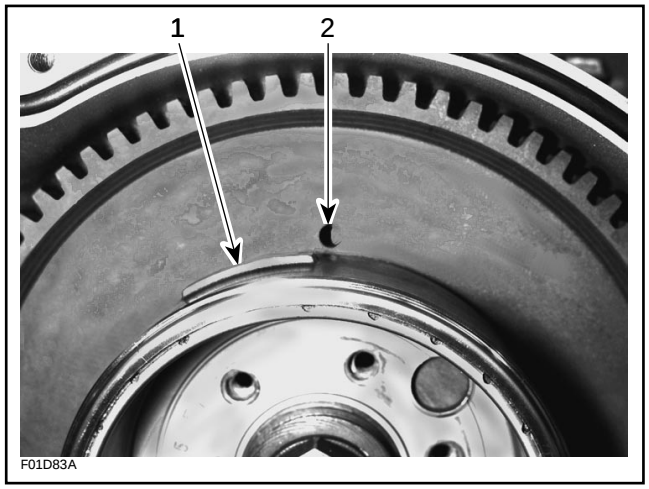
Install gasket between magneto housing and engine crankcase.

Install magneto housing and torque screws to 9 N•m (80 lbf•in).

15,16,17, Rotor Flywheel and Nut

When reinstalling magneto rotor to engine flywheel, apply Loctite 648 to mating surfaces.

One of the protuberance end of magneto rotor must align with hole of engine flywheel.



1. Protuberance
2. Hole

Apply Loctite 242 (blue) on crankshaft taper.

Apply Loctite 242 (blue) on nut threads. Install nut with lock washer and torque to 105 N•m (77 lbf•ft).

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CAUTION : Never use any type of impact wrench at magneto installation.

All Engines

1,2, Magneto Housing Cover and Screw

Properly install O-ring in magneto housing. Apply Loctite 767 Anti-seize on screw threads, install cover, wire support and spark plug grounding device (587 and 717 engines) then torque screws in a criss-cross sequence to 9 N•m (80 lbf•in).

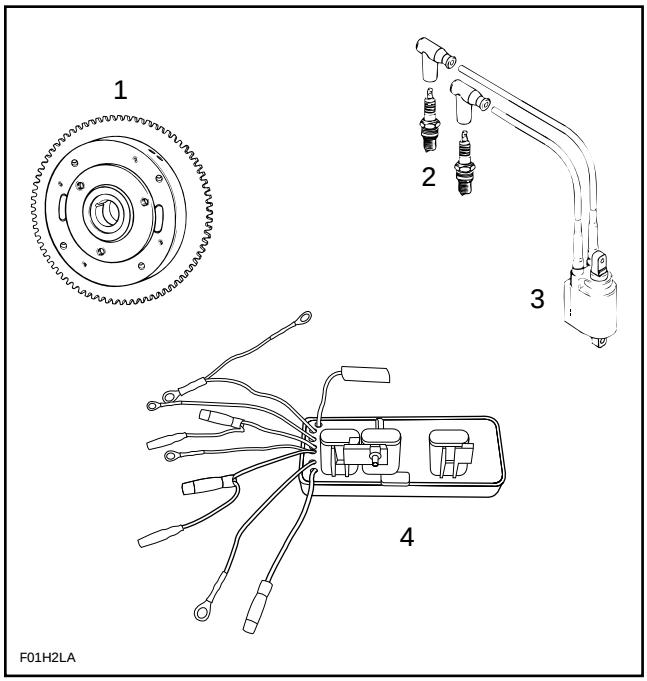
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IGNITION SYSTEM

GENERAL

587 and 717 Engines

The Capacitor Discharge Ignition system includes the following components :

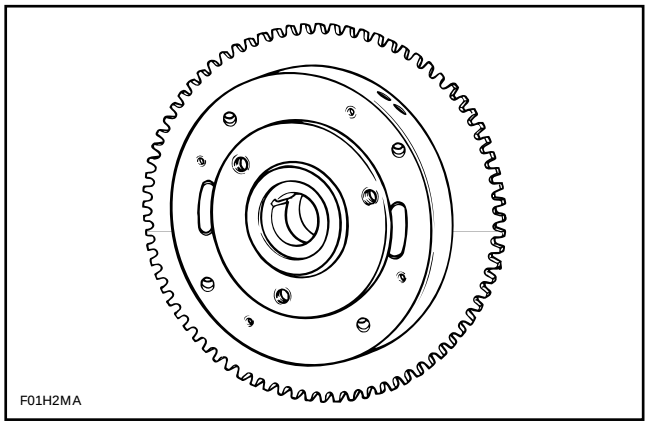


CDI SYSTEM

1. *Magneto*
2. *Spark plugs*
3. *Ignition coil with integrated CDI module*
4. *Multi-purpose electronic module*

Magneto

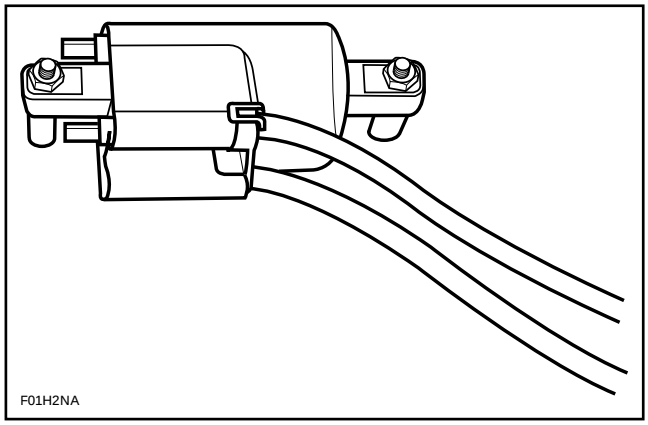
It is the primary source of electrical energy. It transforms magnetic field into electric current through a generating coil.



Ignition Coil

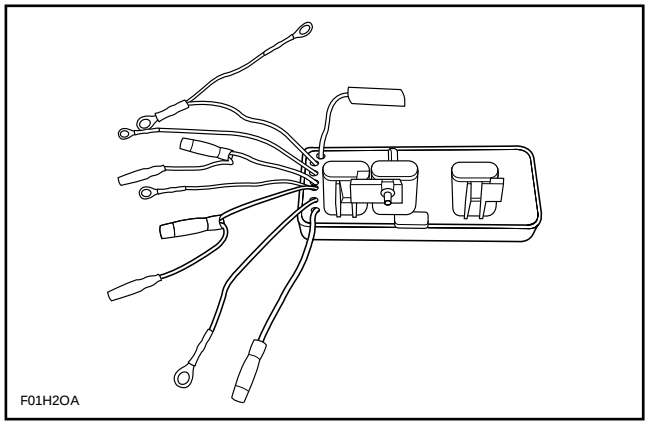
It receives its energy from the generating coil via a BLACK / RED wire. The generating coil allows a current flow through ignition coil with its integrated CDI module and through primary windings.

Ignition coil induces voltage to a high level in secondary windings to produce a spark at spark plug.



Multi-Purpose Electronic Module

It receives its current from the battery. It includes the engine rev limiter and also an integrated delay timer which cut off the electrical circuit after approximately 33 seconds of non-use when the safety lanyard cap is on switch. Delay timer can be activated by depressing start / stop button when safety lanyard is removed.



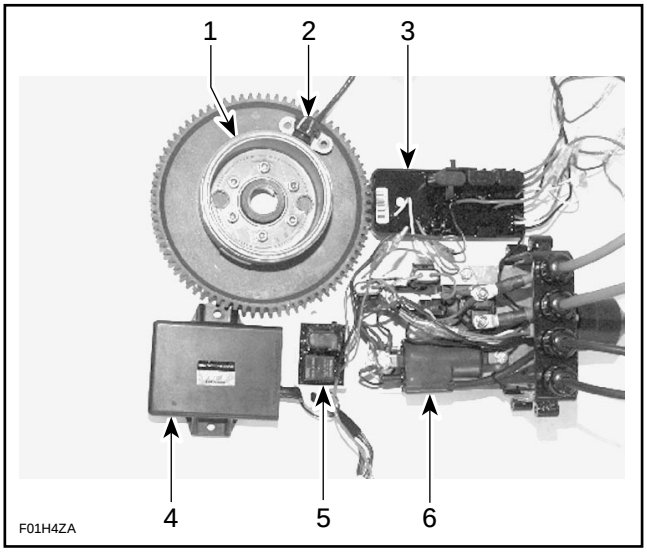
TYPICAL

NOTE : The fuses are directly mounted onto theMPEM.

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787 Engine

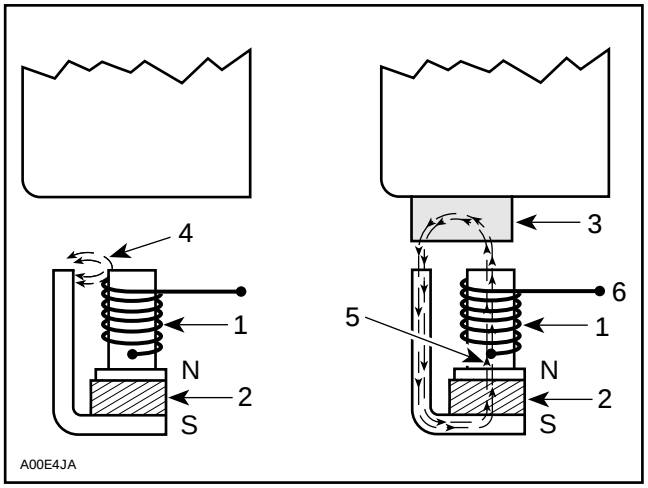
The 787 engine has a digital DC-CDI (Direct Current-Capacitor Discharge Ignition) system. The high amperage / voltage components are located into a rear electrical box (next to the battery). The other components are located in the conventional electrical box. The ignition system includes the following components :



1. *Rotor*
2. *Trigger coil*
3. *MPEM*
4. *Digital DC-CDI module*
5. *Holder relay*
6. *Ignition coil*

Magneto Rotor / Trigger Coil

The trigger coil is mounted outside the rotor (inside the magneto housing of the engine) and is not adjustable. It's purpose is to signal the DC-CDI to be conductive at the proper number of degrees before TDC (Top Dead Center). The rotor has two protrusions (180 degrees apart) that, when coupled with the trigger coil, accomplish the signaling.



1. *Coil*
2. *Magnet*
3. *Rotor protrusion*
4. *Magnetic field outside of coil*
5. *Magnetic field crossing coil*
6. *Current to CDI module*

DC-CDI Module

The DC-CDI module receives the input from the trigger coil and signals the ignition coil when to fire. It also has the rev limiter function built into its circuitry, as well as the ignition timing curve. The DC-CDI module is mounted in the cover of the conventional electrical box.

WIRE COLOR	FUNCTION
RE/PU	CDI power source from MPEM through holder relay
BK	Grounded in main electrical box
WH	To ignition coil
YL/WH	Impulse from trigger coil
BK/OR	Blanks-not used at this time
BK/GR	Blanks-not used at this time
BK	Ground between CDI and MPEM
GY/WH	RPM data to MPEM
WH/BL	Data to MPEM (low voltage)

Multi-Purpose Electronic Module (MPEM)

The MPEM has a micro processor inside of its sealed case and basically is responsible for : interpreting information, distribution of information, and as a timed /untimed power source. The MPEM is mounted in the conventional electrical box. Wire connections are as follows :

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WIRE	FUNCTION
WH/GY	Communication for DESS lanyard
TA	Power to the monitoring beeper and sensor
PU	Power
BK/YL	Safety lanyard switch (DESS)
YL/RE	Start/stop witch (handlebar)
WH/BL	Data transfer (low voltage)
GY/WH	RPM data to MPEM
BK	Ground between CDI and MPEM
BK	External ground
BK	Ground for safety lanyard
YL/RE	Starter relay
RE/PU	Power to instrument (oil/fuel/etc.)
RE/BL	Power to holder relay

Holder Relay

The holder relay is used to prevent discharge of the battery, through the ignition system, when the craft is not running. The relay is in the conventional electrical box.

Ignition Coil

The ignition coil steps up the voltage input from the DC-CDI module and the end result is firing of the spark plugs. Output of this coil has been increased by 3KV. The coil is housed in the rear electrical box.

All Engines

Engine Rev Limiter

It has 3 functions :

- Keeps high voltage away from safety lanyard switch.
- Provides engine stop by grounding the primary coil.
- Limits engine RPM to prevent over-revving.
- A defective rev limiter may cause the following problems :
- No spark.
- Uninterruption of spark when engine start / stop and safety lanyard switch is used.
- Incorrectly controlled engine maximum RPM.
- Misfiring / black fouled spark plugs.

To check engine rev limiter, connect an induction tachometer (P / N 295 000 100), start engine and check its maximum speed ; it should be around 6550 ± 50 RPM for a 587 engine, 7000 ± 50 RPM for a 717 engine, and 7200 ± 50 RPM for a 787 engine.

IGNITION TIMING PROCEDURE

Before checking ignition timing with a stroboscopic timing light (dynamic test), it is mandatory to scribe a timing mark on the PTO flywheel (static test) corresponding to the specific engine.

Also, the timing mark scribed on the PTO flywheel can be used to troubleshoot a missing or broken magneto woodruff key.

NOTE : Do not use the factory mark found on the PTO flywheel to check ignition timing or troubleshoot any problems.

CAUTION : The relation between the PTO flywheel mark position and crankshaft position may change as the PTO flywheel is screwed on the crankshaft. As an example, when the PTO flywheel is reinstall on the crankshaft, it can slightly turns on the crankshaft when the engine is accelerated, even if it is properly torqued. This is enough to obtain a false ignition timing reading. Always verify PTO flywheel mark position (static test) before checking ignition timing with an appropriate timing light (dynamic test).

787 Engine

Normally ignition timing adjustment should not be required. It has been set at factory and it should remain correctly adjusted since every part is fixed and not adjustable. The only time the ignition timing might have to be changed would be when replacing the crankshaft, the magneto flywheel, the trigger coil, the DC-CDI module or the MPEM. If the ignition timing is found incorrect, you should first check for proper crankshaft alignment. This might be the indication of a twisted crankshaft.

With this new CDI system, the ignition timing can be checked with either the engine hot or cold. Also, the ignition timing is to be checked at 3500 RPM with the timing light.

Between 3000 and 4000 RPM, the spark advance does not change. So when checking timing at 3500 RPM, a change in engine speed within ± 500 RPM will not affect the timing mark when checked with the timing light.

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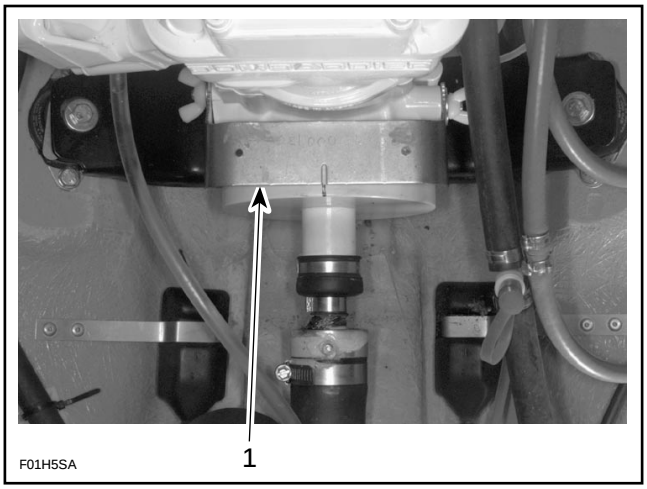
Static Test

All Engines

1. Disconnect MAG side spark plug wire and connect wire to grounding device then remove spark plug.
2. Remove PTO flywheel guard.

587 and 717 Engines

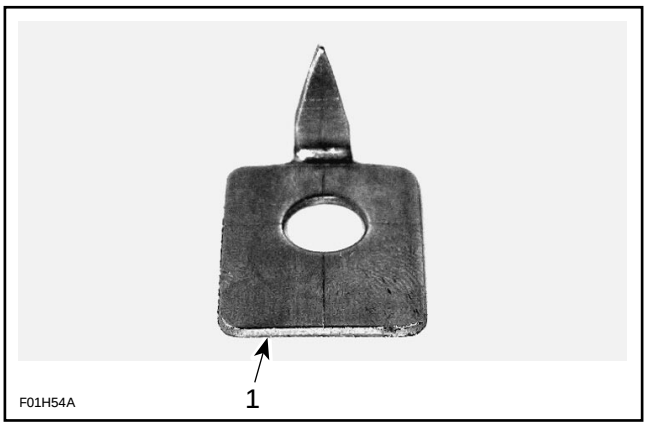
3. Install timing mark pointer tool on engine using wing nuts previously removed.



1. Timing mark pointer tool (P / N 295 000 102)

787 Engine

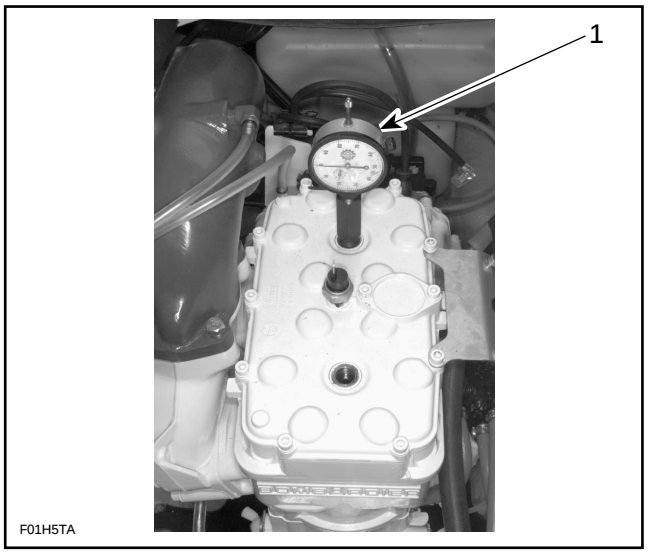
3. Remove middle screw securing the engine to the rear engine mount. Reinstall screw with timing mark pointer tool.



1. Timing mark pointer tool (P / N 295 000 135)

All Engines

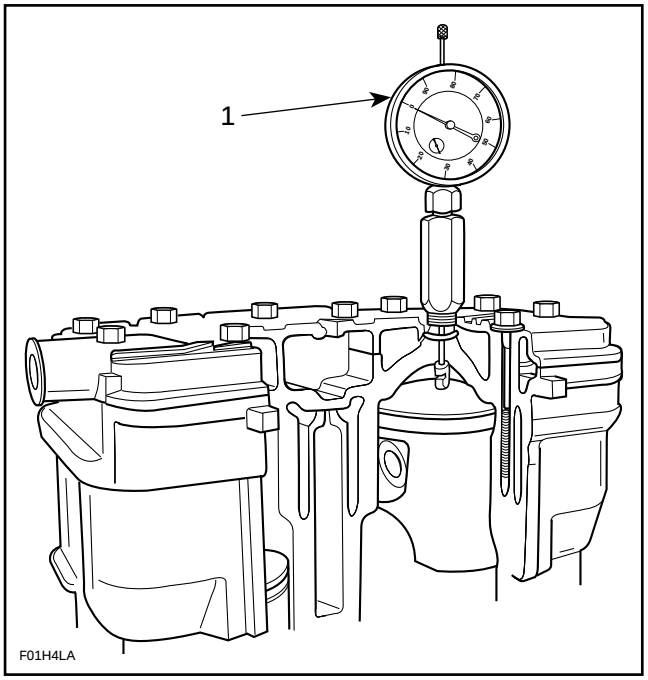
4. Install and adjust a TDC gauge (P / N 295 000 065) in MAG side spark plug hole.



TYPICAL

1. TDC gauge on MAG side

5. Rotate PTO flywheel counterclockwise (when facing it) until piston is at top dead center.



TYPICAL

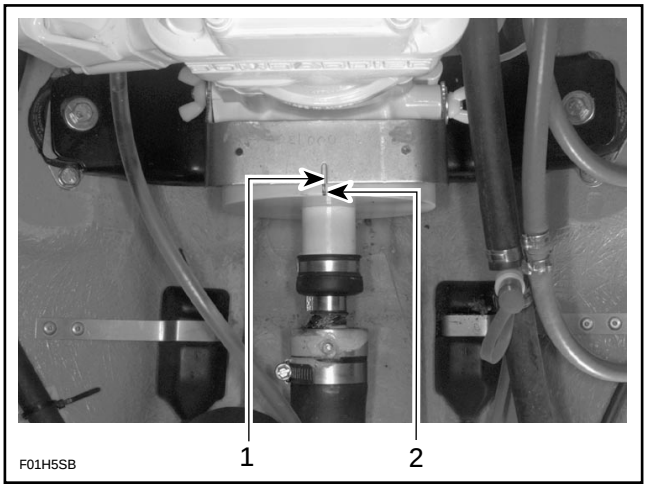
1. Adjust gauge dial at zero

6. From this point, rotate flywheel clockwise to reach proper specification according to engine. Refer to the following chart.

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ENGINE	IGNITION TIMING (BTDC)
587	2.41 mm (.095 in)
717	2.59 mm (.102 in)
787	3.38 mm (.133 in)

7. Scribe a thin mark on PTO flywheel in the middle of tool slot (587 and 717 engines) or aligned with timing mark pointer tool (787 engine).



TYPICAL

1. *Tool slot*
2. *Flywheel mark*

NOTE : This mark becomes the reference when using the stroboscopic timing light.

CAUTION : The static test cannot be used as a timing procedure, therefore, always check the timing with a stroboscopic timing light.

8. Remove TDC gauge.
9. Reinstall spark plug and connect wire.

Dynamic Test

587 and 717 Engines

To check ignition timing, use Bombardier timing light (P / N 295 000 078).

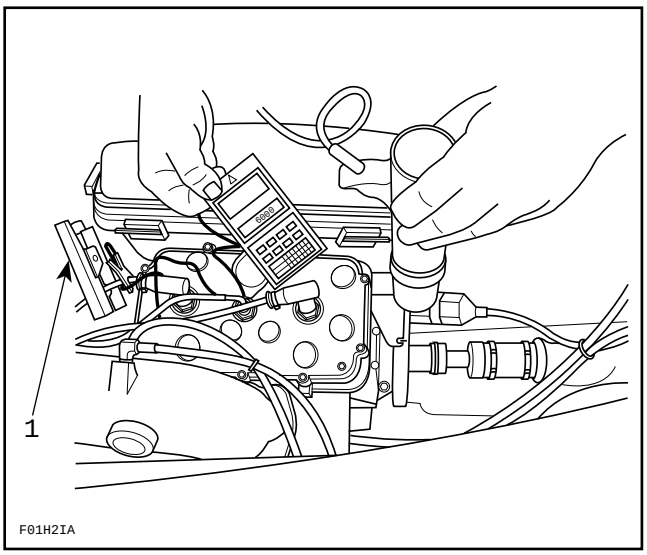
NOTE : To perform this procedure, make sure to use a stroboscopic timing light rated up to 6000 RPM. Otherwise, an inaccurate reading will be obtained.

The ignition components are affected by temperature variation, therefore, timing must be checked when engine is cold, after idling for a MAXIMUM of 20 seconds.

1. Connect timing light pick-up to MAG side spark plug wire.
2. Connect an induction-type tachometer (P / N 295 000 100) to spark plug wire.

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3. Start engine and point timing light straight in line with timing tool slot. Bring engine to 6000 RPM .



TYPICAL

1. Timing light pick-up on MAG side

▼ CAUTION : If engine is to be run more than a few seconds, water must be supplied to the engine.

4. Check if PTO flywheel mark aligns with timing tool slot.

○ NOTE : On this NIPPONDENSO system, timing advance decreases as engine speed increases.

If timing mark aligns with tool slot, timing is properly set. If not, refer to Ignition Timing Adjustment in this sub-section.

787 Engine

1. Connect an induction-type tachometer (P / N 295 000 100) to spark plug wire.
2. Check ignition timing using a stroboscopic timing light connected to the MAG side spark plug cable. Rev the engine to 3500 RPM and point beam of timing light straight in line with timing mark pointer.

▼ CAUTION : If engine is to be run more than a few seconds, connect coupler hose (P / N 295 500 258) and supply water to the engine to properly cool it.

○ NOTE : If mark on PTO flywheel is perfectly aligned with timing mark pointer, no adjustment is required. If it is not the case, refer to Ignition Timing Adjustment in this sub-section.

Ignition Timing Adjustment

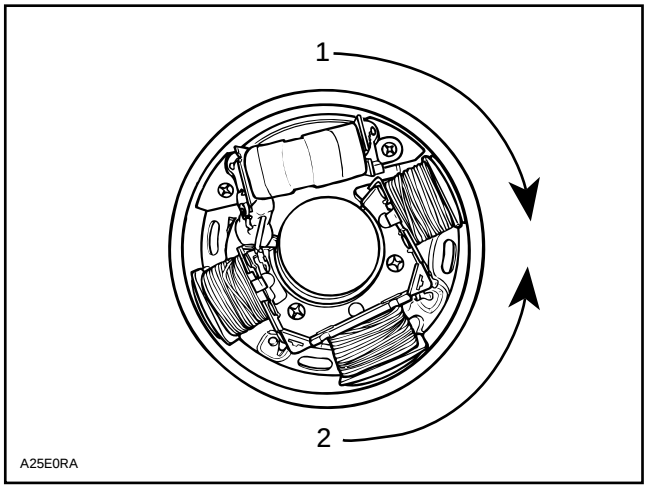
587 and 717 Engines

Remove battery (except HX).

Remove magneto housing cover and grounding device.

For removal of magneto, refer to ELECTRICAL SYSTEM 08-01.

Timing is performed by moving armature plate ; clockwise to retard spark occurrence or counter-clockwise to advance.



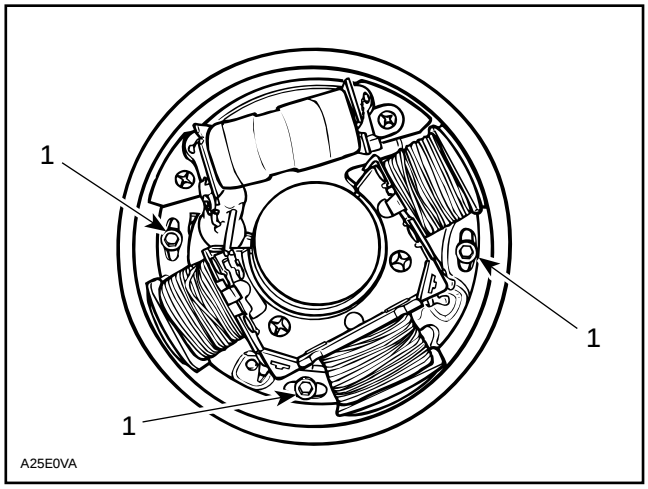
TYPICAL

1. To retard
2. To advance

To adjust, loosen 3 armature plate retaining screws and slightly rotate armature plate in proper direction.

○ NOTE : As a guideline, turn the armature plate the same amount needed to align mark on PTO flywheel.

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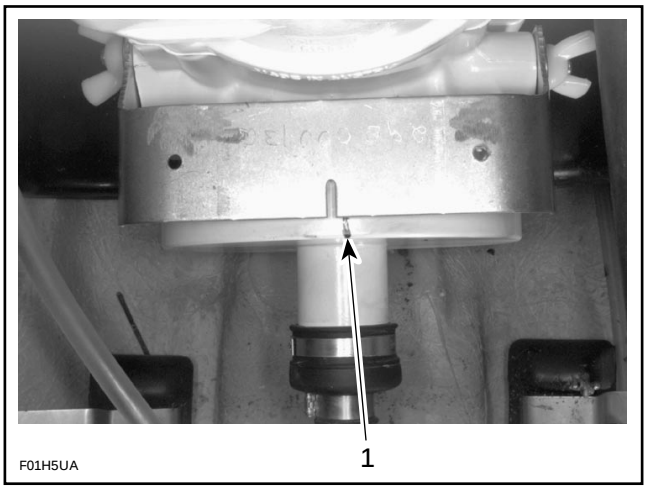


TYPICAL

1. Retaining screw

Example 1

When PTO flywheel mark is on right side of timing tool slot, it indicates advanced timing.

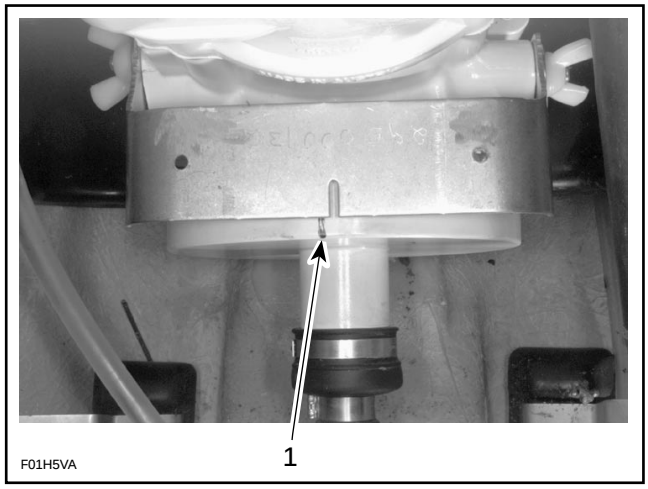


1. Too advanced timing

In this case, turn armature plate clockwise when facing it.

Example 2

When PTO flywheel mark is on left side of timing tool slot, it indicates retarded timing.



1. Retarded timing

In this case, turn armature plate counterclockwise when facing it.

After adjustment, tighten armature plate retaining screws.

▼ CAUTION : Armature plate screws must have Loctite 242 (blue) applied before tightening. Make sure armature plate screws are well secured.

Reinstall removed parts. Refer to ELECTRICAL SYSTEM 08-01.

Recheck ignition timing (make sure engine is cold).

Repeat armature plate positioning procedure if timing mark position is not adequate.

787 Engine

Since the trigger coil on this engine is fixed and not movable to correct the ignition timing, the MPEM programmer (P / N 295 000 127) is now used to set the timing when an adjustment is required. The programmer will act as if you were moving the trigger coil to advance or retard the ignition timing.

○ NOTE : For more information on the programmer, refer to its guide.

Through the MPEM programmer, the ignition timing can be advanced up to 3° or retarded up to 4°. If the timing is adjusted too retarded, a performance decrease of the engine will be noticed. If the timing is adjusted too advanced, serious engine damage will occur.

▼ CAUTION : If the ignition timing is adjusted too advanced, this will cause serious damage to the engine.

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The timing mark refer to the physical component position when the spark must occur. The DC-CDI module must be synchronized with the mark. For instance, on a particular engine, the timing correction may need to be advanced to 2° so that the mark aligns with timing mark pointer tool. This is not the real spark advance, just a correction for the tolerances of the mechanical components.

Knowing that, you select with the programmer the higher or lower number to advance or retard the actual timing correction by referring to the following chart.

TIMING CORRECTION CHART	
Programmer number (MPEM)	Ignition Timing Correction
2	3°
3	2°
4	1°
1	0
5	-1°
6	-2°
7	-3°
8	-4°

Examples :

a. You found the flywheel mark advanced. You must retard the ignition timing.
   - The programmer gives you the number 3. Referring to the chart, number 3 returns a correction of 2° (advanced) and this is too much in this case.
   - You estimate the correction should be set to 1° (advanced) to align flywheel mark. Back in the chart, look to find 1° (advanced). This gives number 4. Enter this number with the programmer.
   - You recheck the timing with the timing light and if the mark is aligned, ignition timing is properly set.

b. You found the flywheel mark advanced. You must retard the ignition timing.
   - The programmer gives you the number 3. Referring to the chart, number 3 returns a correction of 2° (advanced) and this is too much in this case.
   - You estimate the correction should be set to 1° (advanced) to align flywheel mark. Back in the chart, look to find 1° (advanced). This gives number 4. Enter this number with the programmer.
   - You recheck the timing with the timing light and found that the flywheel mark is still too advanced. You know now that the correction made previously was not enough and you estimate the correction should be set to - 2° (retarded) to align flywheel mark. Back in the chart, look to find - 2° (retarded). This gives number 6. Enter this number with the programmer.
   - You recheck the timing with the timing light and if the mark is aligned, ignition timing is properly set.

c. You found the flywheel mark retarded. You must advance the ignition timing.
   - The programmer gives you the number 4. Referring to the chart, number 4 returns a correction of 1° (advanced) and this is not enough in this case.
   - You estimate the correction should be set to 2° (advanced) to align flywheel mark. Back in the chart, look to find 2° (advanced). This gives number 3. Enter this number with the programmer.
   - You recheck the timing with the timing light and if the mark is aligned, the ignition timing is properly set.

Proceed as follows to adjust the ignition timing with the MPEM programmer :

1. Connect the communication cable to the MPEM programmer and the other end to the safety lanyard switch on the craft.
2. Press the *ON / C* button on programmer and enter your password.
3. Press *3* to choose *Vehicle info* in programmer.
4. Press *4* to choose *Engine param.*
5. Press *2* to choose *Timing adjust*.
6. The programmer display a number that is actually stored in the MPEM.
7. Press -- to choose *yes* for modify then press *Enter*.
8. Now punch in the number that corresponds to the degree you want for the ignition timing then press *Enter*.
9. Press *Menu* to go back one level.

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10. Press *8* to choose *Save + Quit* (even if item no. 8 is not visible on the display, it is active when you select it).
11. Press *Enter* to confirm yes you want to *save modifications* to the MPEM.
12. You must see *Operation successful*. This confirms that the new timing has been stored in the MPEM.
13. Unplug communication cable from safety lanyard switch on craft.
14. .Press *Off* to close the programmer.

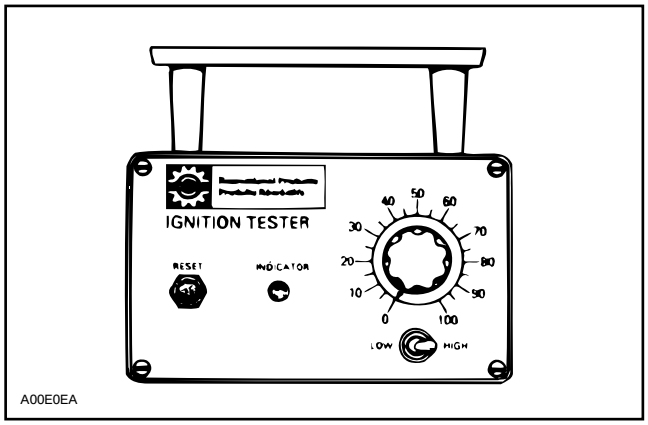
At this point, you can install the watercraft safety lanyard and start the engine to check the effect of the correction on the ignition timing. If further adjustment is required, repeat the procedure.

NOTE : The MPEM module features a permanent (non-volatile) memory and keeps the ignition timing programmed even when the watercraft battery is disconnected.

BOMBARDIER IGNITION TESTER

Use of Bombardier Ignition tester

This tester (P / N 295 000 008) can verify generating coil and ignition coil / CDI module of the ignition system.



Always make sure that tester batteries are in good condition.

Test Condition

All tests are performed on watercraft at cranking speed with spark plugs installed.

Always proceed in the following order :

1. Connect tester P and N clip leads as indicated for each specific test.
2. Follow test procedure sequence.
3. Install cap over safety lanyard switch and crank engine until light turns on, or otherwise, for a maximum of 5 seconds.
4. After every test that lights the indicator lamp, RESET the indicator circuit by depressing the reset button.

Analysis of Test Results

INDICATOR LAMP LIGHTS AT SPECIFIC SETTING

Output is as specified. Test results should repeat 3 times. If readings do not repeat, output is erratic and cause should be investigated (loose connections or components, etc.).

INDICATOR LAMP LIGHTS AT LOWER SETTING

This indicates that the output is less than that designed to operate in a satisfactory manner. However, before coming to the conclusion of a faulty condition be certain that correct engine cranking conditions were met before condemning the tested part.

INDICATOR LAMP DOES NOT LIGHT

One component is defective. Proceed as instructed to find defective component.

INTERMITTENT IGNITION PROBLEMS

In dealing with intermittent problems there is no easy diagnosis. For example, problems that occur only at normal engine operating temperature have to be tested under similar conditions.

In most cases of temperature and / or vibration failure, only parts replacement can solve the problem as most of these failures return to normal when engine is not running.

MULTIPLE PROBLEMS

There is always the possibility of more than one faulty part. If after a component has been replaced, the problem still persists, carefully repeat the complete test procedure to find the other faulty part.

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SAFETY PRECAUTIONS

◆ WARNING : To prevent powerful electric shocks while cranking engine, neither touch any electronic ignition components (ignition coil, high tension wires, etc.) nor tester lead clips. Also make sure that tester leads do not touch any metallic object. Ventilate bilge at least two minutes prior to performing any test.

IGNITION SYSTEM TESTING PROCEDURE

When dealing with ignition problems, the following items should be verified in this order.

1. Spark occurence / spark plug condition.
2. Battery condition.
3. Electrical connections.
4. Engine start / stop switch.
5. Safety lanyard switch.
6. Delay timer .
7. Multi-purpose electronic module (MPEM).
8. Magneto output.
9. Ignition coil output.

▼ CAUTION : Whenever replacing a component in ignition system, check ignition timing.

○ NOTE : To perform verification, a good quality multimeter such as Fluke 73 (P / N 529 022 000) can be used.

Engine Start / Stop Switch Verification

Disconnect the YELLOW / RED wire in the electrical box. Using an ohmmeter, connect test probes to YELLOW / RED wire and to ground near solenoid.

Measure resistance, it must be an open circuit (switch is normally open). Depress and hold switch, the ohmmeter should read close to 0 ohm.

Safety Lanyard Switch Verification

Disconnect the BLACK and BLACK / YELLOW wires in the electrical box. Using an ohmmeter, connect test probes to switch wires.

Measure resistance, it must be close to 0 ohm when cap is over switch and an open circuit when removed.

Delay Timer Verification

The timer is integrated into the MPEM.

Always confirm first that the fuses are in good condition.

To confirm operation of timer, remove safety lanyard from switch and depress start / stop button once. The timer should stay on for about 33 seconds (for example, fuel gauge will be activated) and then turn off.

587 and 717 Engines

Multi-Purpose Electronic Module (MPEM) Verification

The multi-purpose electronic module testing must be done with all wires disconnected from circuit. Otherwise testing equipment (ohmmeter) could be damaged.

▼ CAUTION : When disconnecting wires, BLACK /RED wire must never touch solenoid positive terminal. When replacing a MPEM, make sure to replace it with the right model.

Refer to the following chart for MPEM testing. Always respect polarity in chart.

Meter (+) lead	Meter (-)	Value
Red (ring terminal)	Red (female terminal)	< 1Ω
Red (ring terminal)	Red/Purple (female terminal)	< 1Ω
Red (ring terminal)	Black (ring terminal)	> 20 kΩ
Black/Red	Black (ring terminal)	> 10 kΩ
White/Grey	Black (ring terminal)	> 100 kΩ
Tan/Black	Black (ring terminal)	> 200 kΩ
Yellow/Red (female terminal)	Black (ring terminal)	> 10 kΩ
Yellow/Red (male terminal)	Black (ring terminal)	> 50 kΩ
Black (ring terminal)	Red (ring terminal)	> 10 kΩ

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Most of circuit can be tested with an ohmmeter but a 100 % test doesn't mean the MPEM is in perfect condition.

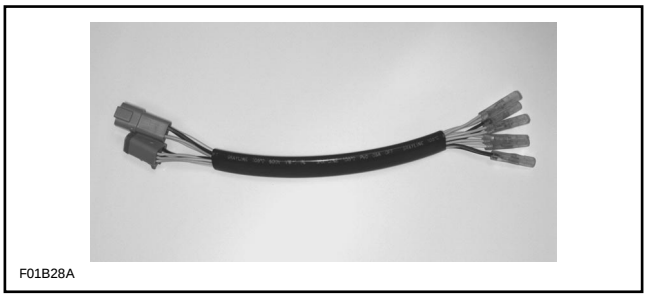
▼CAUTION : Whenever connecting MPEM, always have battery disconnected from circuit. If MPEM must be connected when circuit is activated, always connect BLACK / RED wire first to ignition coil / CDI module to prevent wire from touching solenoid positive terminal.

Generating Coil Verification

STATIC TEST

Disconnect magneto wiring harness connector.

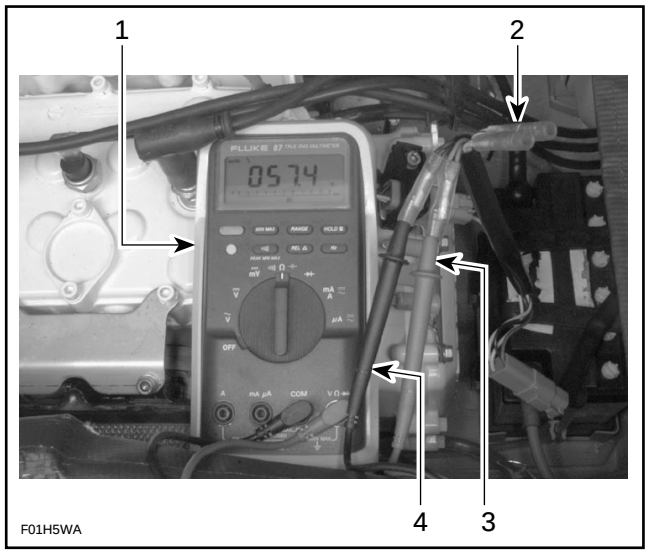
Install the four-pin magneto harness adapter (P / N 295 000 131).



TYPICAL

Check resistance with a high-sensitivity ohmmeter. Refer to the following table for values and wire colors.

PART NAME	ADAPTER WIRE	RESISTANCE (Ω)
Generating coil	Black with RED/BLUE	40-76



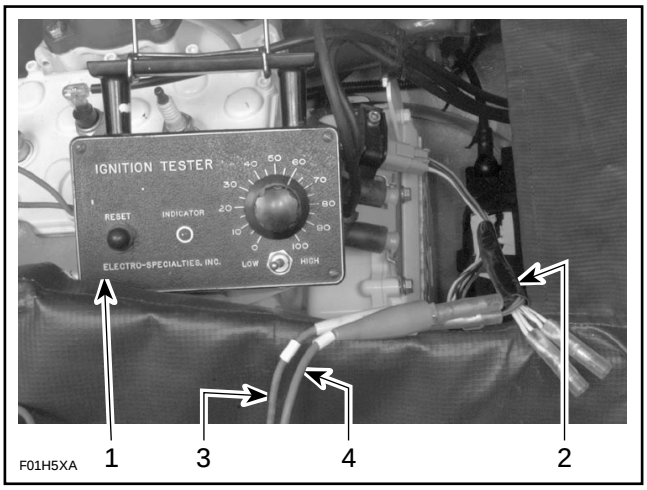
1. *Multimeter*
2. *Four-pin magneto harness adapter*
3. *RED / BLUE wire*
4. *BLACK wire*

DYNAMIC TEST

1. Connect spark plug cables to grounding device.
2. Disconnect magneto wiring harness connector.
3. Install the four-pin magneto harness adapter (P/ N 295 000 131).
4. Connect probe ''N'' of Bombardier Ignition Tester to RED / BLUE wire of four-pin magneto harness adapter.
5. Connect probe ''P'' of Bombardier Ignition Tester to BLACK wire of four-pin magneto harness adapter.
6. Set Bombardier Ignition Tester as per following table :

Tester probe	Adapter wire	Tester switch position	Tester dial position
N	RED/ BLUE	LOW	60
P	BLACK		

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1. *Bombardier ignition tester*
2. *Four-pin magneto harness adapter*
3. *Probe ''N'' to RED / BLUE wire*
4. *Probe ''P'' to BLACK wire*

7. Crank engine and observe indicator.
8. Push reset button and repeat test twice.

Results :

a. Indicator lamp lights : Generating coil output is up to specifications.

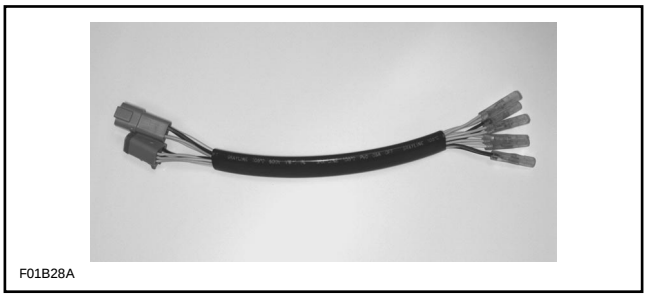
b. Indicator lamp does not light : The problem is a faulty generating coil. Replace it.

787 Engine

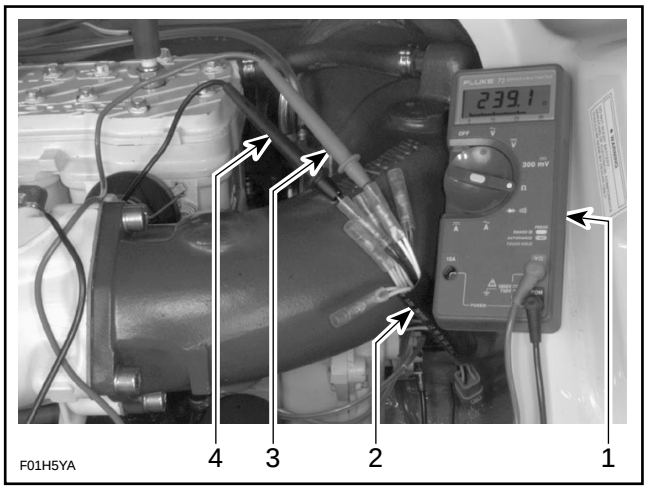
Trigger Coil Verification

STATIC TEST : CONTINUITY

1. Disconnect magneto wiring harness connector.
2. Install the six-pin magneto harness adapter (P / N 295 000 136).



3. Connect one multimeter lead to the WHITE wire of the six-pin magneto harness adapter.
4. Connect the other multimeter lead to the BLACK / YELLOW wire of the six-pin magneto harness adapter.
5. Measure resistance; it should be between 190-300 ohms.



1. *Multimeter*
2. *Six-pin magneto harness adapter*
3. *WHITE wire*
4. *BLACK / YELLOW wire*

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DC-CDI Module Verification

STATIC TEST : CONTINUITY

+ Meter Lead	- Meter Lead	Value
RE/PU	BK	2.6 kΩ
YL/WH	BK	0.380 MΩ
WH	BK	2.208 MΩ
BK/OR	BK	infinity
BK/GR	BK	infinity
BK	BK	0.2 Ω
WH/BL	BK	30.38 kΩ
BK	RE/PU	2.690 kΩ
BK	YL/WH	0.390 MΩ
BK	WH	2.2 MΩ
BK	BK/OR	infinity
BK	BK/GR	infinity
BK	BK	2.69 kΩ
BK	GY/WH	33.07 kΩ

Multi-Purpose Electronic Module (MPEM) Verification

STATIC TEST : CONTINUITY

The multi-purpose electronic module testing must be done with all wires disconnected from circuit. Otherwise testing equipement (ohmmeter) could be damaged.

NOTE : < = less than > = greater than

+ Meter Lead	- Meter Lead	Value
RE/PU (male connector)	RE	< 1 Ω
RE/PU (male connector)	RE/PU (female connecto)	< 1 Ω
RE/PU (male connector)	BK (ring terminal)	> 20 kΩ
WH/GY	BK (ring terminal)	> 100 kΩ
TA/BL	BK (ring terminal)	> 10 kΩ
PU/WH	BK (ring terminal)	> 2 kΩ > 2.4 Ω
YL/RE (female connector)	BK (ring terminal)	> 10 kΩ
YL/RE (male connector)	BK (ring terminal)	> 50 kΩ
GY/WH	BK (ring terminal)	> 9 kΩ < 11 Ω
WH/BL	BK (ring terminal)	> 4.3 kΩ < 4.9 kΩ
WH/BL	PU/WH	> 2.2 kΩ < 2.6 kΩ
BK (ring terminal)	RE (ring terminal)	> 10 kΩ

Holder Relay Verification

STATIC TEST : CONTINUITY

1. Disconnect the PURPLE / BLUE and BLACK wires coming out from the holder relay.
2. Connect meter leads to above wires and resistance of holding coil should be 104 ohms (±10%).

DYNAMIC TEST

1. Disconnect all 4 wires to the holder relay.
2. Set meter to resistance scale, connect meter leads to RED / BLUE and RED / PURPLE wires (there should be no reading).
3. Jumper DC (battery) voltage : positive lead to PURPLE / BLUE, negative to BLACK.
4. By energizing the coil, the switch should have closed, the ohmmeter should read less than 0.5 ohm resistance.

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Ignition Coil Verification

STATIC TEST

NOTE : An ignition coil with good resistance measurement can still be faulty. Voltage leak can occur at high voltage level which is not detectable with an ohmmeter.

Primary Winding

587 and 717 Engines

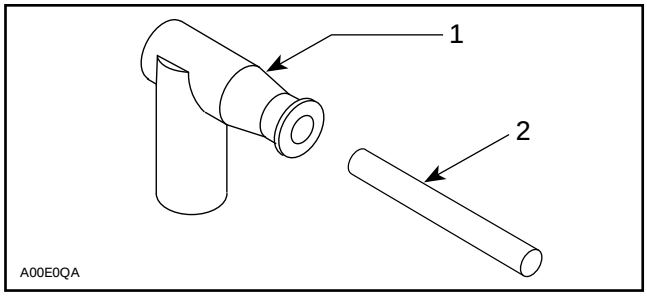
Due to the integrated CDI module, it is not possible to take any resistance measurement.

787 Engine

1. Remove the 2 female spade connectors from the primary side of the ignition coil.
2. With the meter set on the resistance scale, connect the meter leads to the primary terminals of the coil.
3. Resistance should be between 0.34 - 0.62 ohm.

Secondary Winding

The spark plug caps must be removed from high tension cables, because they are resistor caps. The cap resistance is 4.48 K ohms.



1. Resistor cap
2. High-tension cable

IGNITION COIL		
PART NAME	WIRE	RESISTANCE (Ω)
Secondary widing	End of each spark plug cable, spark plug caps removed	9-15 k

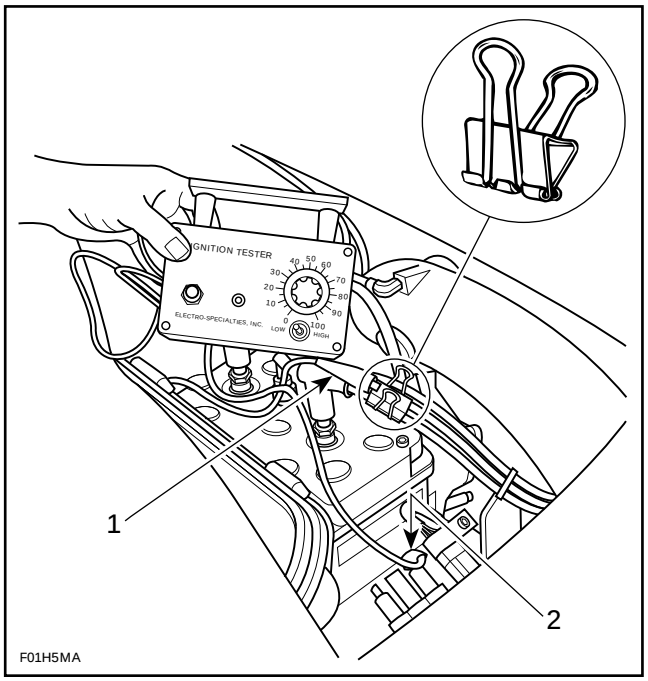
NOTE : A short circuit will read 0 ohm (or close to) on ohmmeter.

DYNAMIC TEST

A paper clip of approximately 20 mm (3/4 in) will be used as a test adapter for the following test.

1. Install the test adapter to spark plug cable close to MAG side spark plug.
2. Connect Bombardier Ignition Tester probes then set switch and dial as follows :

Tester probe	Component	Tester switch position	Tester dial position
N	Tester adapter (paper clip) on spark plug cable	LOW	50
P	Grounding device		



TYPICAL

1. N lead on paper clip
2. P lead to grounding device

3. Start engine and observe indicator.

NOTE : If engine starts, allow it to idle while observing indicator. Then, shut engine off.

4. Push reset button and repeat test twice.

Results :

a. Indicator lamp lights : Ignition coil is OK.

b. Indicator lamp does not light : Ignition coil is faulty. Replace it.

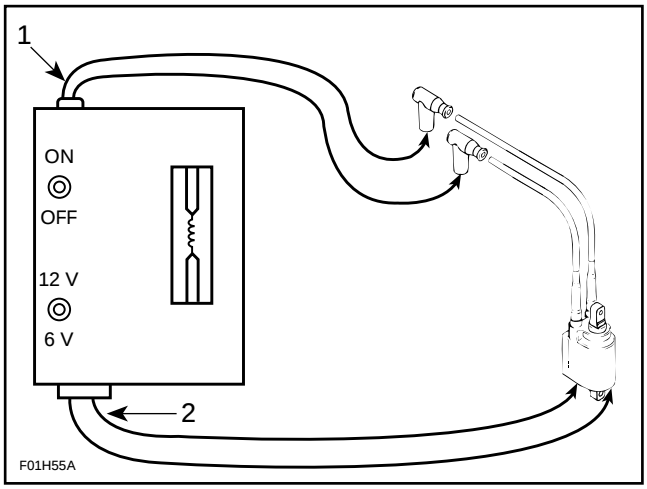
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787 Engine Only

As an alternate method, use KOWA ignition coil tester (or equivalent), available from after market tool / equipment suppliers.

▼ CAUTION : Do NOT use coil tester on metal work bench. Follow manufacturer instructions.

1. With ignition coil removed from craft, disconnect spark plug caps from high tension cables.
2. Hook high tension leads from tester to ignition coil high tension cables.
3. Connect 2 smaller tester leads to primary of ignition coil.



TYPICAL

1. Leads to secondary
2. Leads to primary

4. Turn power switch to 12 volts and you should observe spark jumping at a predetermined gap of 7 to 8 mm (.276 to .311 in).

If there is no spark, if it is weak or intermittent, the coil is defective and should be replaced.

SPARK PLUGS

Disassembly

First unscrew the spark plug one turn.

Clean the spark plug and cylinder head with pressurize air then completely unscrew.

Heat Range

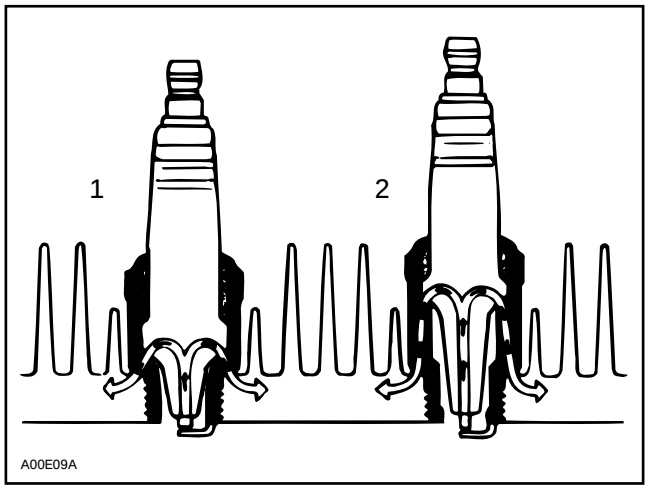
The proper heat range of the spark plugs is determined by the spark plugs ability to dissipate the heat generated by combustion.

The longer the heat path between the electrode tip to the plug shell, the hotter the spark plug operating temperature will be – and inversely, the shorter the heat path, the colder the operating temperature will be.

A “cold” type plug has a relatively short insulator nose and transfers heat very rapidly into the cylinder head.

Such a plug is used in heavy duty or continuous high speed operation to avoid overheating.

The “hot” type plug has a longer insulator nose and transfers heat more slowly away from its firing end. It runs hotter and burns off combustion deposits which might tend to foul the plug during prolonged idle or low speed operation.



1. Cold
2. Hot

▼ CAUTION : Severe engine damage might occur if a wrong heat range plug is used.

A too “hot” plug will result in overheating and pre-ignition, etc.

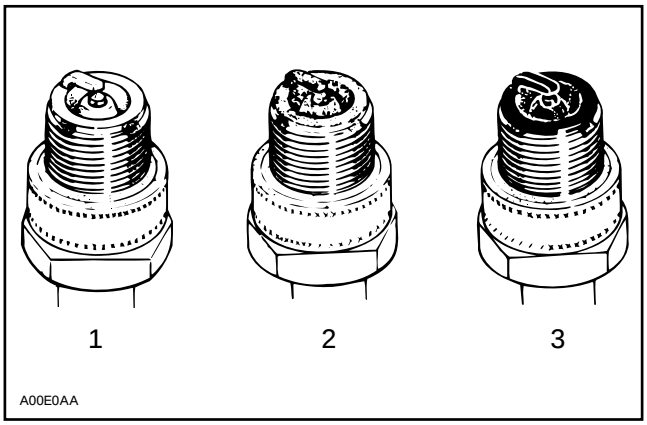
A too “cold” plug will result in fouling or may create carbon build up which can heat up red-hot and cause pre-ignition or detonation.

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Fouling

Fouling of the spark plug is indicated by irregular running of the engine, decreased engine speed due to misfiring, reduced performance, and increased fuel consumption. This is due to a loss of compression. Other possible causes are : prolonged idling, or running on a too rich mixture due to a faulty carburetor adjustment or incorrect fuel. The plug face of a fouled spark plug has either a dry coating of soot or an oily, glossy coating given by an excess either of oil or of oil with soot. Such coatings form a conductive connection between the center electrode and ground.

Spark Plug Analysis



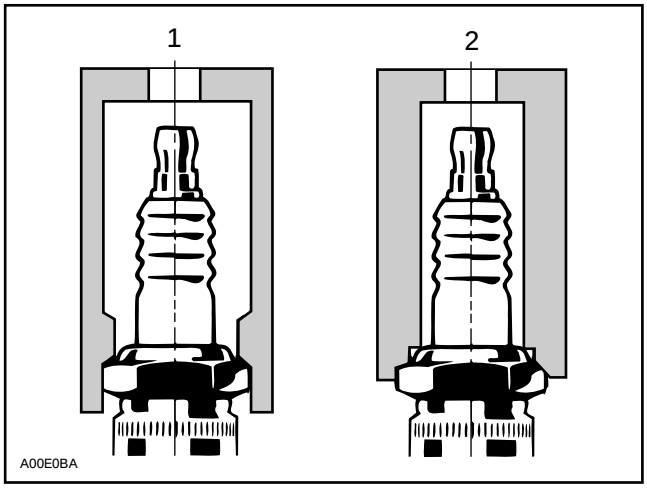
1. Overheated (light grey)
2. Normal (brownish)
3. Fouled (black)

The plug face (and piston dome) reveals the condition of the engine, operating condition, method of driving and fuel mixture. For this reason it is advisable to inspect the spark plug at regular intervals, examining the plug face (i.e. the part of the plug projecting into the combustion chamber) and the piston dome.

Spark Plug Installation

Prior to installation make sure that contact surfaces of the cylinder head and spark plug are free of grime.

1. Using a wire feeler gauge, set electrode gap according to the following chart.
2. Apply anti-seize lubricant over the spark plug threads to prevent possible seizure.
3. Hand screw spark plug into cylinder head and tighten with a torque wrench and a proper socket.



1. Proper socket
2. Improper socket

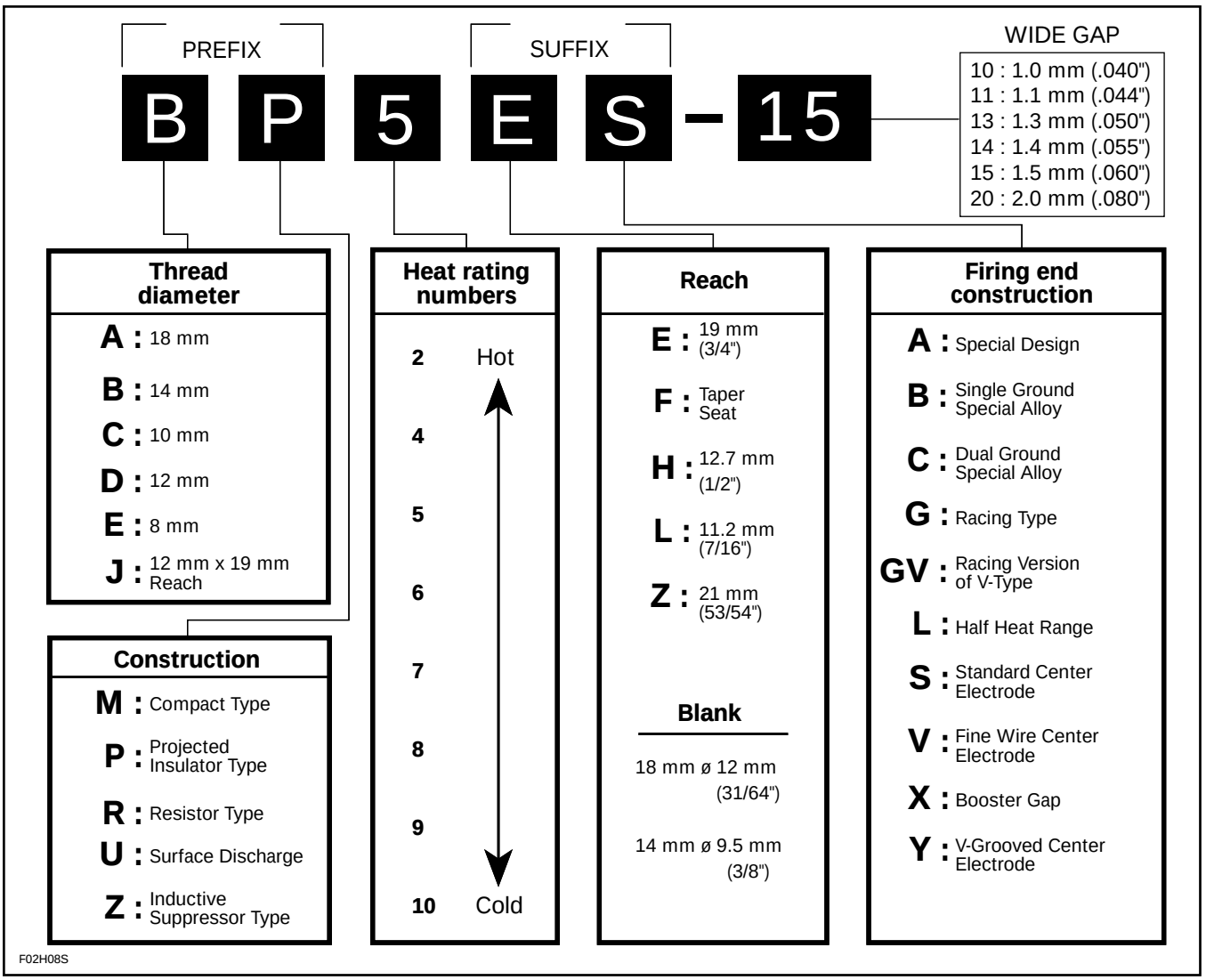
Spark Plug Chart

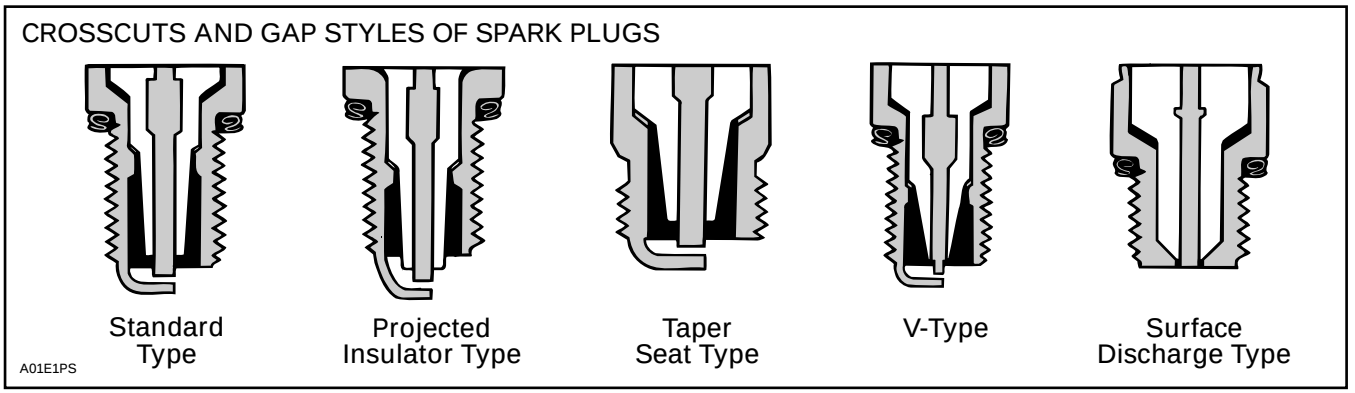
Watercraft models	Engine	Spark plugs	Torque N•m (lbf•ft)	Gap mm (inch)
SP SPI GTS	587	NGK BR8ES	24 (17)	0.5-0.6 (.020-.024)
SPX GTI HX	717	NGK BR8ES	24 (17)	0.5-0.6 (.020-.024)
XP	787	NGK BR8ES	24 (170	0.5-0.6 (.020-.024)

NOTE : Refer to next page for Spark Plug Symbol Explanation.

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Spark Plug Symbol Explanation





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CHARGING SYSTEM

GENERAL

Magneto

The purpose of the charging system is to keep the battery at a full state of charge.

The magneto is the primary source of electrical energy. It transforms magnetic field into electric current (AC).

587 and 717 Engines

The magneto has a three-pole coil. Capacity is 160 watts.

787 Engine

The magneto has a 3 phase, "Y" wound stator on 18 poles. Capacity is 180 watts.

Rectifier / Regulator

587 and 717 Engines

A half-wave rectifier receives magneto AC current and transforms it into direct current (DC) to allow battery charging.

Included in the same unit, a regulator keeps voltage at a steady level (14.5 - 14.8 volts) to prevent any damage to components.

787 Engine

A dual 1/2 wave series rectifier receives the magneto AC current and transforms it into direct current (DC) to allow battery charging.

Included in the same unit, a regulator keeps voltage at a steady level (14.5 - 14.8 volts) to prevent any damage to components.

Battery

The battery is the DC source for electric starter, multipurpose electronic module and all accessories.

Fuse

A 15 A fuse protects the charging system. If the battery is regularly discharged, check fuse condition.

NOTE : On the XP model, there is two 15 A fuses.

The rectifier / regulator is often the culprit of a blown fuse. To check, simply disconnect the rectifier / regulator from the circuit.

If the fuse still burns, check for a defective wire.

CAUTION : Do not use a higher rated fuse as this cause severe damage.

TESTING PROCEDURE

NOTE : First, ensure that battery is in good condition prior to performing the following tests.

Current Test

Proceed as follows :

– Start engine.

– Lay an inductive ammeter on positive cable of battery.

– Bring engine to approximately 5500 RPM.

Depending on battery charge, current reading should be approximately 4 amperes for the 587 and 717 engines or 5 amperes for the 787 engine. If not, check magneto output prior to concluding that rectifier is faulty.

Voltage Test

Proceed as follows :

– Start engine.

– Connect a DC voltmeter on battery posts.

– Bring engine to approximately 5500 RPM.

If voltmeter reads over 15 volts, regulator is defective. Replace it.

NOTE : Whatever the voltmeter type used (peak voltage or RMS), the voltage must not exceed 15 V. A faulty regulator will allow voltage to exceed 15 V as engine speed is increased.

Rectifier / Regulator

STATIC TEST : CONTINUITY

1. Due to internal circuitry, there is no static test available.

DYNAMIC TEST

Refer to Voltage test above.

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NOTE : If it is continually necessary to add distilled water to the battery, this indicates an over voltage situation, requiring replacement of the rectifier / regulator. If, on the other hand, the battery will not stay charged, the problem can be any of the charging circuit components. If these all check good, you would be accurate in assuming the problem to be in the rectifier / regulator.

Battery Charging Coil

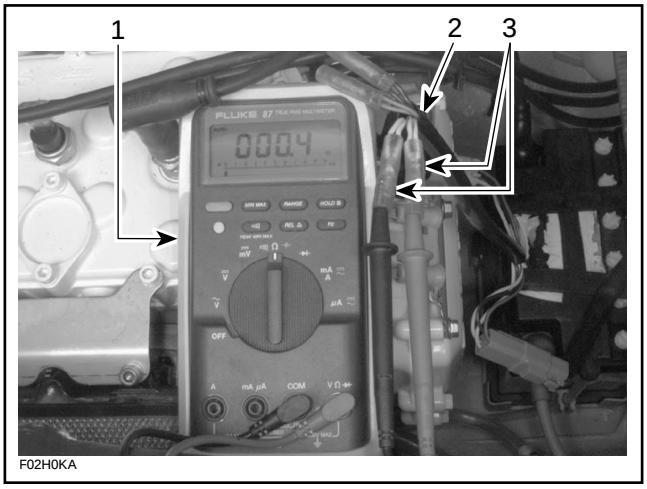
587 and 717 Engines

STATIC TEST : CONTINUITY

1. Disconnect the magneto wiring harness connector.
2. Install the four-pin magneto harness adapter (P / N 295 000 131).
3. Check resistance between the YELLOW and YELLOW / BLACK wires of the magneto harness adapter. Refer to the following table.

PART NAME	ADAPTER WIRE COLOR	RESISTANCE (Ω)
Battery charging coil	YELLOW with YELLOW/BLACK	0.05-0.6

NOTE : A short circuit will read 0 ohm (or closeto) on ohmmeter.

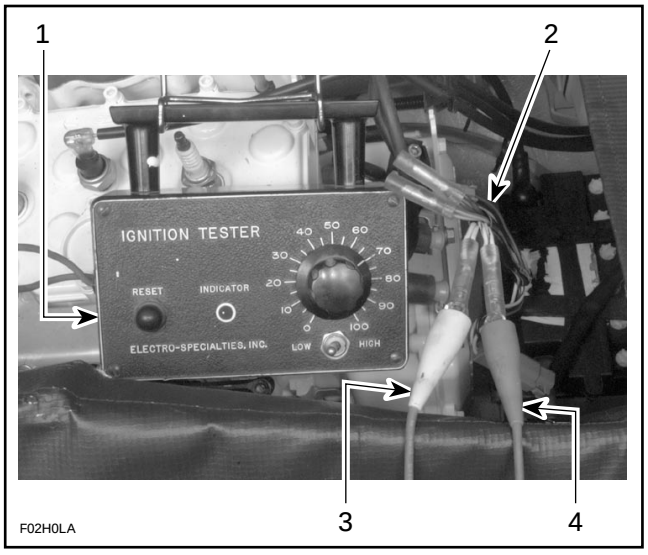


1. Multimeter
2. Magneto harness adapter
3. YELLOW and YELLOW / BLACK wires

DYNAMIC TEST

1. Disconnect the magneto wiring harness connector.
2. Install the four-pin magneto harness adapter (P / N 295 000 131).
3. Connect and set Bombardier Ignition Tester as per following table.

Tester wires	Adapter wire color	Tester switch position	Tester dial position
N	YELLOW	LOW	70
P	YELLOW/BLACK		



1. Bombardier Ignition Tester
2. Magneto harness adapter
3. Probe ''N'' to YELLOW wire
4. Probe ''P'' to YELLOW / BLACK wire

4. Crank engine and observe indicator.
5. Push reset button and repeat test twice.

Results :

a. Indicator lamp lights : Battery charging coil output is up to specifications.

b. Indicator lamp does not light : Battery charging coil is faulty. Replace it.

Stator

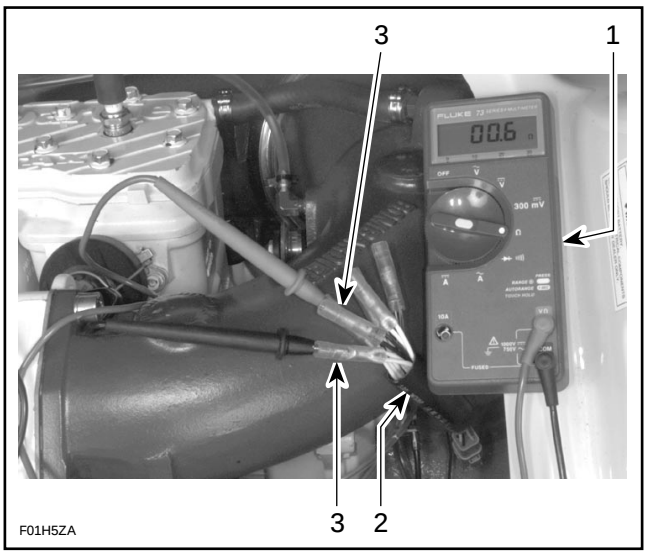
787 Engine

STATIC TEST : CONTINUITY

1. Disconnect the magneto wiring harness connector.
2. Install the six-pin magneto harness adapter (P / N 295 000 136).

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3. Check resistance between two of the YELLOW wires. The resistance should be between 0.1 - 1.0 ohm.

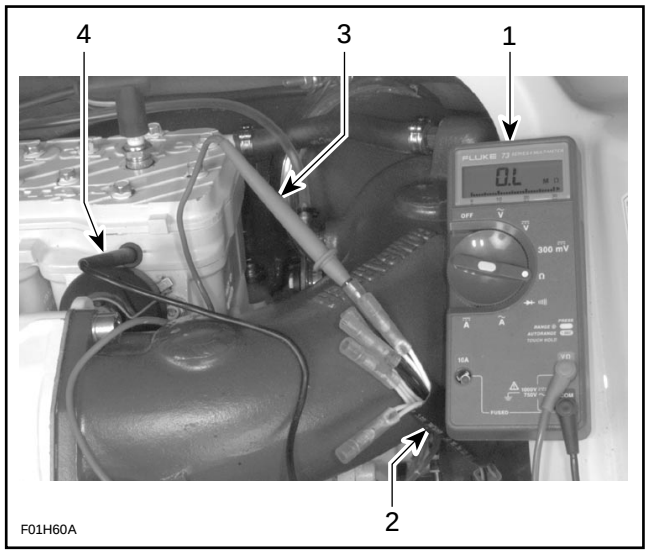


1. Multimeter
2. Magneto harness adapter
3. YELLOW wires

4. Place either meter lead into the remaining YELLOW wire and note the resistance (same as step no. 3). If the readings are out of specification, the stator will need to be replaced.

STATIC TEST : INSULATION

1. Disconnect the magneto wiring harness connector.
2. Install the six-pin magneto harness adapter (P / N 295 000 136).
3. Insert multimeter + lead to one of the YELLOW wire of the six-pin magneto harness adapter.
4. Ground the multimeter - lead to the engine or the stator iron core and note the reading.



1. Multimeter
2. Magneto harness adapter
3. + lead to YELLOW wire
4. - lead to ground

5. Repeat test with the other two YELLOW wires of the six-pin magneto harness adapter.

NOTE : There should be no continuity (infinity) between the stator insulated coils and ground. If there is a reading, the stator coils and / or the wiring from the coils is grounded and needs to be replaced or repaired.

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BATTERY

Troubleshooting

SYMPTOM : DISCHARGED OR WEAK BATTERY	
CAUSE	REMEDY
1. Battery posts and/or cable terminal oxidized.	Clean and coat with dielectric grease.
2. Loose or bad connections.	Check wiring and connector cleanliness, damaged or short circuit.
3. Faulty battery (sulfated, doesn't keep a full charge, damaged casing, loose post).	Replace.
4. 15 amp fuse burnt or faulty rectifier.	First check fuse. If it is in good condition, regulator.
5. Faulty battery charging coil (or stator)	Replace.

Removal

◆ WARNING : Battery BLACK negative cable must always be disconnected first and connected last. Never charge or boost battery while installed in watercraft.

Proceed as follows :

1. Disconnect the BLACK negative cable first.
2. Disconnect the RED positive cable last.
3. Remove the vent line from the battery.
4. Remove the holding straps.
5. Withdraw battery from watercraft being careful not lean it so that electrolyte flows out of vent elbow.

▼ CAUTION : Should any electrolyte spillage occur, immediately wash off with a solution of baking soda and water.

◆ WARNING : Electrolyte is poisonous and dangerous. Avoid contact with eyes, skin and clothing.

Cleaning

Clean the battery casing, caps, cables and battery posts using a solution of baking soda and water.

▼ CAUTION : Do not allow cleaning solution to enter battery.

Remove corrosion from battery cable terminals and battery posts using a firm wire brush. Rinse with clear water and dry well.

Inspection

Visually inspect battery casing for cracks or other possible damage. If casing is damaged, replace battery and thoroughly clean battery tray and close area with water and baking soda.

◆ WARNING : Should the battery casing be damaged, wear a suitable pair of non-absorbent gloves when removing the battery by hand.

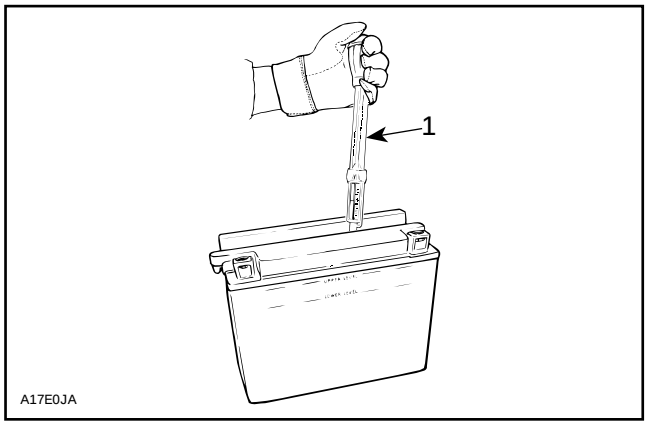
Inspect battery posts for security of mounting.

Inspect for cracked or damaged battery caps, replace defective caps.

◆ WARNING : Battery caps do not have vent holes. Make sure that vent line is not obstructed.

Hydrometer Test

A hydrometer measures the charge of a battery in terms of specific gravity of the electrolyte. Most hydrometers give a true reading at 21°C (70°F).



A. Specific gravity 1.260

In order to obtain correct readings, adjust the initial reading by adding .004 points to the hydrometer readings for each 5.5°C (10°F) above 21°C (70°F) and by subtracting .004 point for every 5.5°C (10°F) below 21°C (70°F).

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This chart will be useful to find the correct reading.

ELECTROLYTE TEMPERATURE		OPERATION TO PERFORM	
°C	°F		
38 32 27	100 90 80	.012 .008 .004	Add to the reading
21	70	correct reading	
16 10 4 –1	60 50 40 30	004 .008 012 016	Subtract from the reading

EXAMPLE NO. 1
Temperature above 21°C (70°F) :
Hydrometer reading : 1.250
Electrolyte temperature : –1°C (30°F)
Subtract .016 Sp. Gr.
Corrected Sp. Gr. is 1.234

EXAMPLE NO. 2
Temperature above 21°C (70°F) :
Hydrometer reading : 1.235
Electrolyte temperature : 38°C (100°F)
Add .012 Sp. Gr.
Corrected Sp. Gr. is 1.247

Battery Storage

Disconnect and remove battery from watercraft.

Check electrolyte level in each cell, add distilled water up to upper level line.

▼ CAUTION : Do not overfill.

The battery must always be stored in fully charged condition. If required, charge until specific gravity of 1.260 is obtained.

▼ CAUTION : Battery electrolyte temperature must not exceed 50°C (122°F). The casing should not feel hot.

Clean battery terminals and cable connections using a wire brush. Apply a light coat of dielectric grease on terminals.

Clean battery casing and caps using a solution of baking soda and water.

▼ CAUTION : Do not allow cleaning solution to enter battery.

Rinse battery with clear water and dry well using a clean cloth.

Store battery on a wooden shelf in a cool dry place. Such conditions reduce self-discharging and keep fluid evaporation to a minimum. Keep battery away from dew, high moisture and direct sunlight.

During the storage period, recheck electrolyte level and specific gravity readings at least every month. If necessary, keep the battery at its upper level line and near full charge as possible (trickle charge).

Activation of a New Battery

◆ WARNING : Never charge or boost battery while installed in watercraft.

A new battery is factory fresh dry charged. For storage purposes, it is fitted with a temporary sealing tube.

▼ CAUTION : Do not remove the sealing tube or loosen battery caps unless activation is desired.

In case of accidental premature removal of caps or sealing tube, battery should be given a full charge.

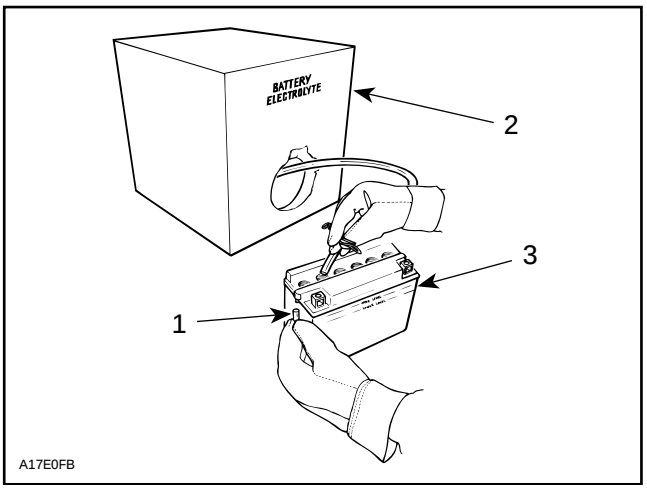
Perform the following operations anytime a new battery is to be installed.

1. Remove the sealing tube from the vent elbow.

◆ WARNING : Failure to remove the sealing tub could result in an explosion.

2. Remove caps and fill battery to UPPER LEVEL line with electrolyte (specific gravity : 1.260 at 21°C (70°F)).

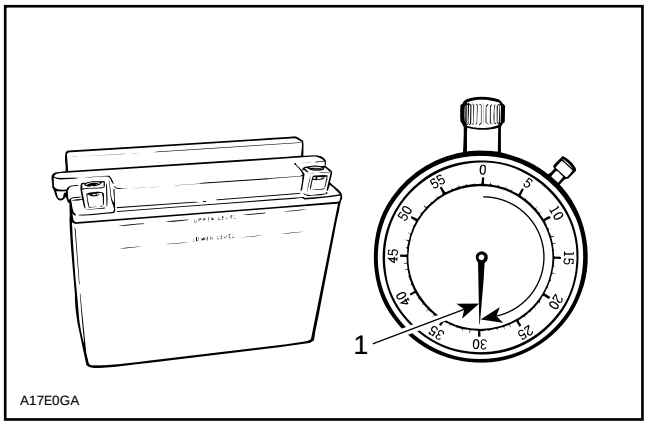
○ NOTE : This battery may fill slower than others due to the anti-spill check ball design.



1. Sealing tube removed
2. Battery electrolyte
3. Upper level line

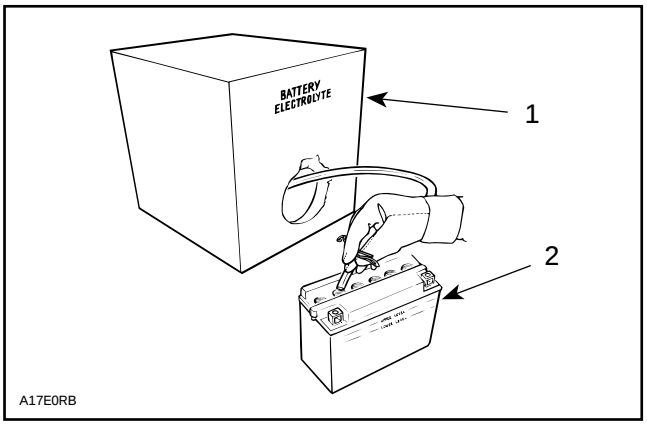
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3. Allow the battery to stand for 30 minutes MINIMUM so that electrolyte soak through battery cells.



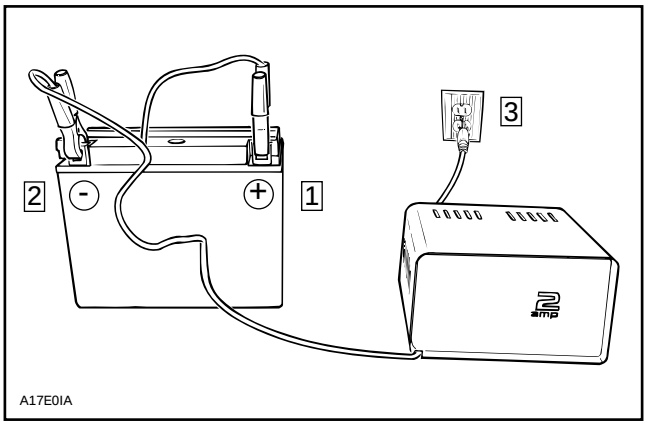
1. 30 minutes

4. Readjust the electrolyte level to the UPPER LEVEL line.



1. Battery electrolyte
2. Upper level line

5. Connect a 2 A battery charger for 3 to 5 hours.

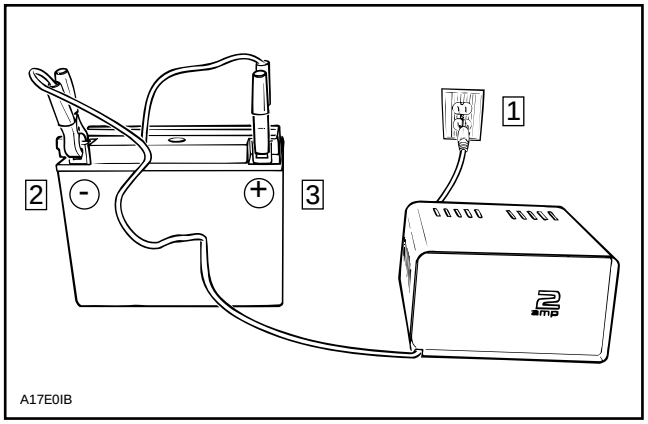


Step 1 Connect + lead to battery + post
Step 2 Connect - lead to battery - post
Step 3 Plug battery charger

▼ CAUTION : If charging rate raises higher than 2.4 A reduce it immediately. If cell temperature rises higher than 50°C (122°F) or if the casing feels hot, discontinue charging temporarily or reduce the charging rate.

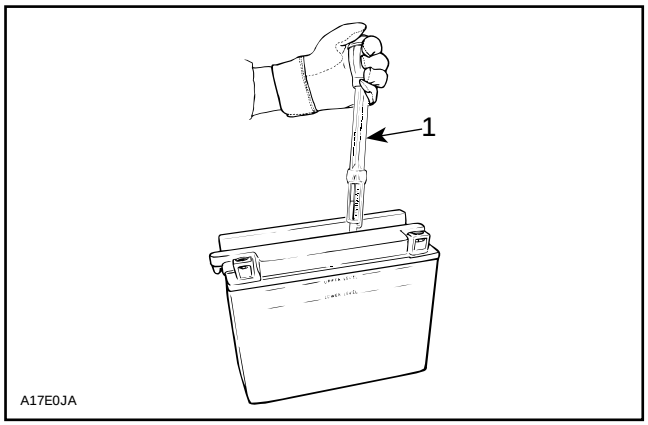
◆ WARNING : Always charge in a well ventilated area. Keep battery away from cigarettes or open flames. Always turn battery charger off prior to disconnecting cables.

6. Disconnect battery charger.



Step 1 Unplug battery charger
Step 2 Disconnect - lead
Step 3 Disconnect + lead

7. Test battery state of charge. Use a hydrometer.



1. Specific gravity 1.260

8. If electrolyte level has dropped after charging, fill with distilled water to UPPER LEVEL line. After water is added, continue charging for 1 to 2 hours to mix water with electrolyte.

9. Reinstall caps and clean any electrolyte spillage using a solution of baking soda and water.

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10.Reinstall battery. Hook up battery cables observing correct polarity and coat terminals with dielectric grease.

Install vent line.

NOTE : A check valve is installed on vent line to prevent water infiltration into battery.

CAUTION : Negative battery terminal should always be disconnected FIRST and reconnected LAST.

WARNING : Vent line must be free and open.

NOTE : It is recommended to verify the battery charge once a month. If necessary, fully charge battery.

Servicing

Electrolyte Level

Since a battery has been activated (see above), add distilled water to top up electrolyte.

Tips for charging a used battery

CAUTION : Prior to charging the battery, always remove it from watercraft to prevent electrolyte spillage.

For best results, battery should be charged when the electrolyte and the plates are at room temperature. A battery that is cold may not accept current for several hours after charging begun.

Do not charge a frozen battery. If the battery charge is very low, the battery may freeze. If it is suspected to be frozen, keep it in a heated area for about 2 hours before charging.

WARNING : Do not place battery near open flame. Always charge in a well ventilated area.

The time required to charge a battery will vary depending on some factors such as :

– Battery temperature : The charging time is increased as the temperature goes down. The current accepted by a cold battery will remain low. As the battery warms up, it will accept a higher rate of charge.
– State of charge : Because the electrolyte is nearly pure water in a completely discharged battery, it cannot accept current as well as electrolyte. This is the reason the battery will not accept current when the charging cycle first begins. As the battery remains on the charger, the current from the charger causes the electrolytic acid content to rise which makes the electrolyte a better conductor and then, the battery will accept a higher charging rate.
– Type of charger : Battery chargers vary in the amount of voltage and current that they can supply. Therefore, the time required for the battery to begin accepting measurable current will also vary.

CHARGING A VERY FLAT OR COMPLETELY DISCHARGED BATTERY:

Unless this procedure is properly followed, a good battery may be needlessly replaced.

– Measure the voltage at the battery posts with an accurate voltmeter. If it is below 10 volts, the battery will accept current at very low rate, in term of milliamperes, because electrolyte is nearly pure water as explained above. It could be some time before the charging rate increases. Such low current flow may not be detectable on some charger ammeters and the battery will seem not to accept any charge.
– Exceptionally for this particular case, set the charger to a high rate.

NOTE : Some chargers have a polarity protection feature which prevents charging unless the charger leads are connected to the correct battery terminals. A completely discharged battery may not have enough voltage to activate this circuitry, even though the leads are connected properly. This will make it appear that the battery will not accept a charge. Follow the charger manufacturer's instruction on how to bypass or override this circuitry so that the charger will turn on and charge a low-voltage battery.

– Since the battery chargers vary in the amount of voltage and current they provide, the time required for the battery to accept measurable charger current might be up to approximately 10 hours or more.
– If the charging current is not up to a measurable amount at the end of about 10 hours, the battery should be replaced.

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– If the charging current is measurable before the end or at the end of about 10 hours, the battery is good and charging should be completed in the normal manner as specified in Activation of a new battery.
– It is recommended that any battery recharged by this procedure be load tested prior to returning it to service.

Battery Charging Equipment

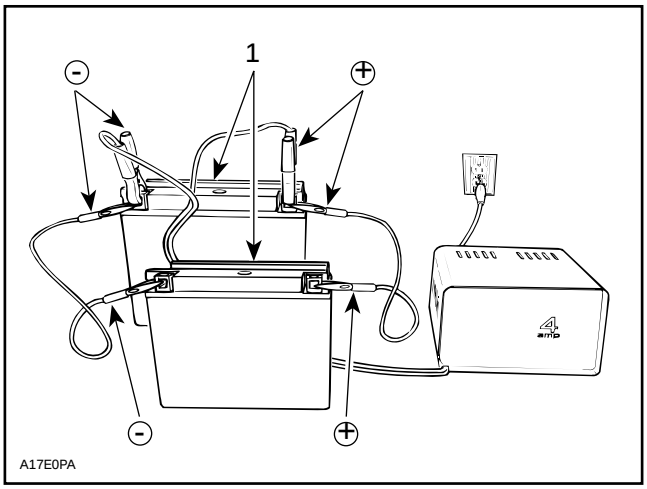
The battery charger should have an adjustable charging rate. Variable adjustment is preferred, but a unit which can be adjusted in small increments is acceptable.

The battery charger must be equipped with an ammeter capable of accurately measuring current of less than 1 ampere.

Charging TWO or More Batteries at a Time

Connect all positive battery posts together and use a charger with a capacity (rated) equal to : number of battery to be charged multiply by 2 A.

For example : Charging 5 batteries at a time requires a 10 A rated charger (5 x 2 A = 10 A).



TYPICAL

1. Two batteries = 4 A

◆ WARNING : Always charge in a well ventilated area.

Installation of Battery

◆ WARNING : Always connect battery cables exactly in the specified order, RED positive cable first BLACK negative cable last.

Proceed as follows :

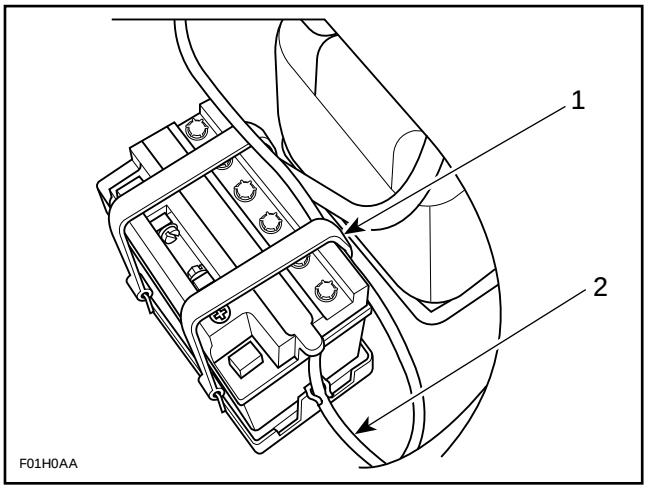
1. Install battery in its emplacement.
2. Secure vent line to the battery and support. Ensure vent line is not kinked or obstructed.

◆ WARNING : Vent line must be free and open. Keep battery away from cigarettes or open flames. Avoid skin contact with electrolyte.

3. First connect RED positive cable.
4. Connect BLACK negative cable last.
5. Apply dielectric grease on battery posts.
6. Verify cable routing and attachment.

All Models Except XP and HX

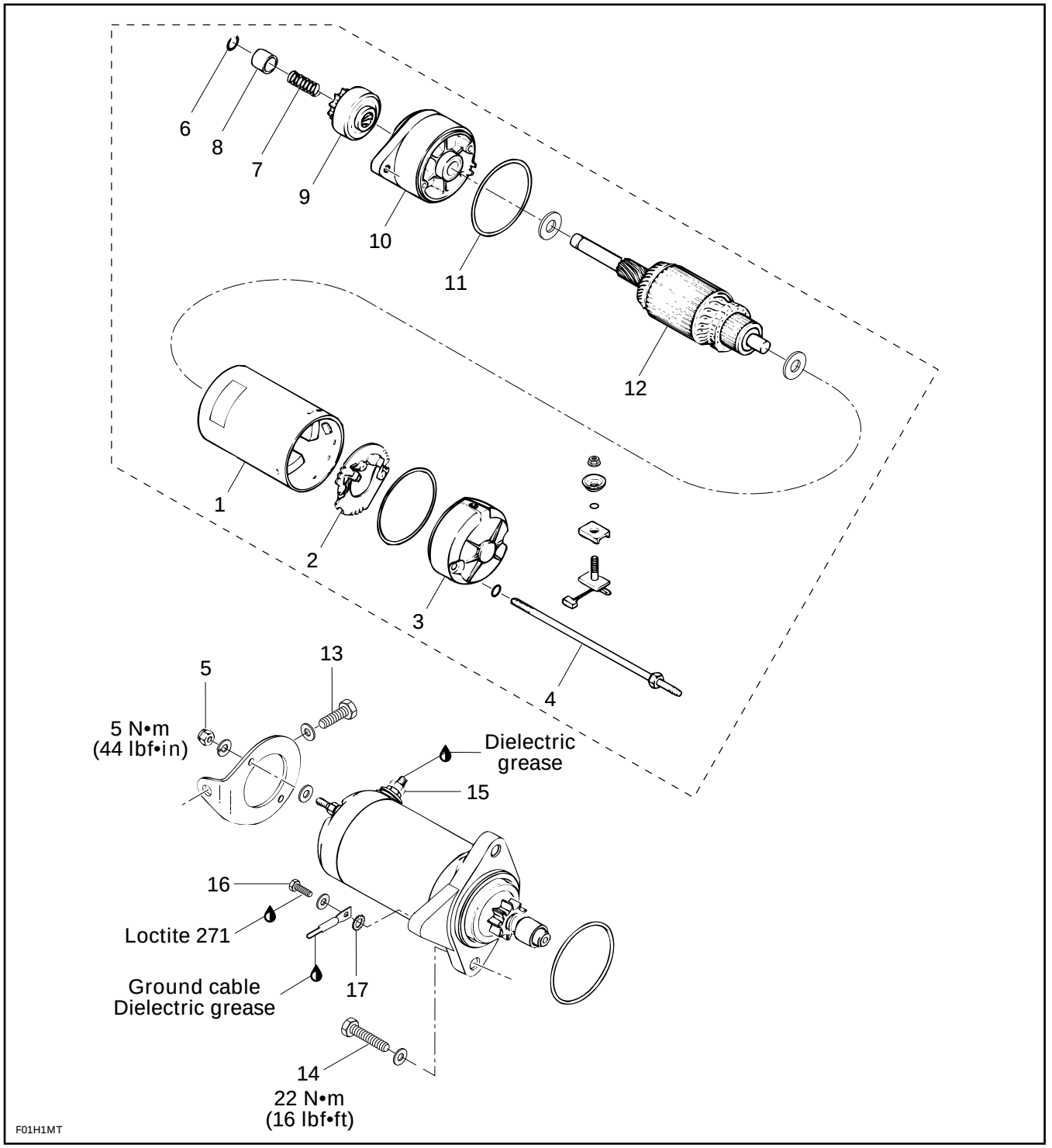
Secure RED positive battery cable using right strap of battery.



1. Strap retaining RED positive cable
2. Vent tube connected and secured in support

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STARTING SYSTEM



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GENERAL

Causes of troubles are not necessarily related to starter but may be due to a burnt fuse, faulty battery, start /stop switch, safety lanyard switch, solenoid, electrical cables or connections.

Check these components before removing starter. Consult also the starting system troubleshooting table on next page for a general view of possible problems.

◆ WARNING : Short circuiting electric starter is always a danger, therefore disconnect the battery ground cable before carrying out any kind of maintenance on starting system. Do not place tools on battery.

Fuse

Make sure 5 A fuse on MPEM is in good condition.

The solenoid may be the cause of a burnt fuse. If the solenoid checks good, one of the accessory may be defective.

Battery

To check battery condition, refer to ELECTRICAL SYSTEM 08-03.

Engine Start / Stop Switch

Switch condition can be checked with an ohmmeter.

Disconnect the YELLOW / RED wire in the electrical box. Connect test probes to YELLOW / RED wire and to ground near solenoid.

Measure resistance, it must be an open circuit (switch is normally open). Depress and hold switch, the ohmmeter should read close to 0 ohm.

Safety Lanyard Switch

Disconnect the BLACK and BLACK / YELLOW wires in the electrical box. Using an ohmmeter, connect test probes to switch wires.

Measure resistance, it must be close to 0 ohm when cap is over switch and an open circuit when removed.

Solenoid

○ NOTE : Solenoid is located in the electrical box.

Inspect connections and clean as necessary.

STATIC TEST : CONTINUITY

With a multimeter, check primary winding resistance. It should be approximately 5 ohms.

There should be no continuity between the positive posts of the solenoid.

DYNAMIC TEST

Depress start / stop button and measure the voltage on the solenoid positive posts with a multimeter.

If there is no voltage and battery is in good condition, replace the solenoid.

Electrical Cables or Connections

Check all connections, cables and wires. Tighten any loose cables. Replace any chafe wires.

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STARTING SYSTEM TROUBLESHOOTING

SYMPTOM	CAUSE	REMEDY
Starter does not turn.	Burnt fuse 5A.	Check wiring condition and replace fuse.
	Poor contact of battery terminal(s).	Clean and tighten terminal(s).
	Poor battery ground cable connection.	Clean and tighten.
	Weak battery.	Recharge or replace battery.
	Poor contact of start / stop switch, safety lanyard switch or solenoid.	Replace.
	Open circuit : start / stop switch, safety lanyard switch or solenoid.	Replace.
Starter engages ; but does not crank the engine.	Poor contact of brush.	Straighten commutator and brush.
	Burnt commutator.	Turn commutator in lathe.
	Worn commutator segments.	Undercut mica.
	Shorted armature.	Repair or replace armature.
	Weak brush spring tension.	Replace brush holder or spring.
	Weak magnet.	Replace yoke assembly.
	Worn bushings.	Replace clutch.
	Weak battery.	Recharge or replace battery.
Starter engages ; but does not crank the engine.	Worn clutch pinion gear.	Replace clutch.
	Defective clutch.	Replace clutch.
	Poor movement of clutch on splines.	Clean and correct.
	Worn clutch bushing.	Replace clutch.
	Worn ring gear.	Replace ring gear.
Starter motor keeps running	Shorted solenoid winding.	Replace solenoid.
	Melted solenoid contacts.	Replace solenoid.
	Sticking or defective starter clutch.	Lubricate or replace.
	Presence of salt water in the electrical box which gives continuity.	Verify electrical box watertightness.

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STARTER REMOVAL

Disconnect BLACK cable ground connection from battery.

◆ WARNING : Always disconnect ground cable first and reconnect last.

Disconnect RED cable connection from battery.

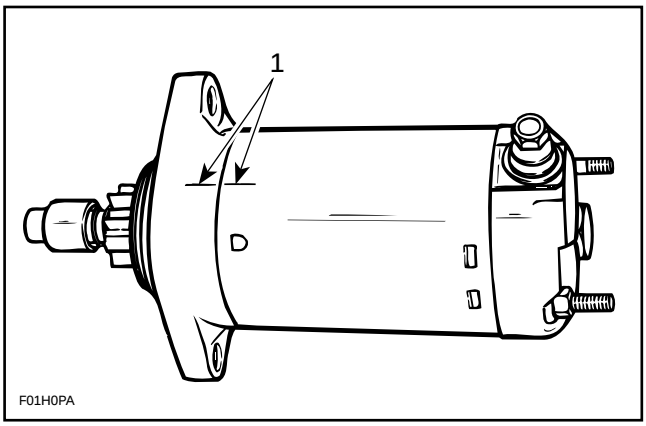
Remove the following parts.

– cables from starter
– screw of starter rear support
– starter mount screws

STARTER DISASSEMBLY

1,2,3,4,5, Yoke, Brush Holder, End Frame, Through Bolt and Nut

Before disassembling, trace index marks on yoke and clutch housing to ease further assembly.



TYPICAL

1. Trace indexing marks

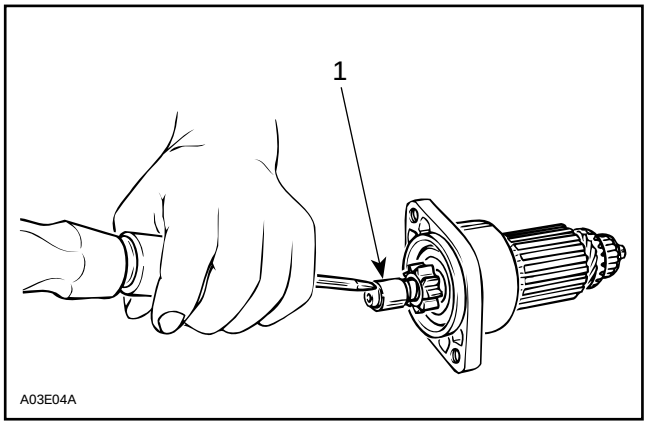
Remove starter support nuts then through bolts. Separate end frame from yoke assembly. Withdraw yoke assembly from armature.

Brush holder can be removed from end frame by unscrewing nut retaining terminal.

Check that the radial play between the armature shaft and end frame is not greater than 0.20 mm (.008 in). Replace end frame if so.

6,7,8, Circlip, Spring and Pinion Stop Collar

Tap the pinion stop collar using a screwdriver. Remove circlip. Disassemble pinion stop collar and spring.



1. Pinion stop collar

9,10,11,12, Clutch Ass'y, Housing, O-ring and Armature

Turn assembly clockwise to remove it from armature assembly.

Pull housing from armature.

CLEANING

▼ CAUTION : Yoke ass'y and drive unit assembly must not be immersed in cleaning solvent.

Discard all O-rings and gasket.

Clean brushes and holders with a clean cloth soaked in solvent. Brushes must be dried thoroughly with a clean cloth.

Blow brush holders clean using compressed air.

◆ WARNING : Always wear safety glasses when using compressed air.

Remove dirt, oil or grease from commutator using a clean cloth soaked in suitable solvent. Dry well using a clean, dry cloth.

Clean engine ring gear teeth and drive unit (clutch).

○ NOTE : Bushings must not be cleaned with grease dissolving agents.

Immerse all metal components in cleaning solution. Dry using a clean, dry cloth.

PARTS INSPECTION

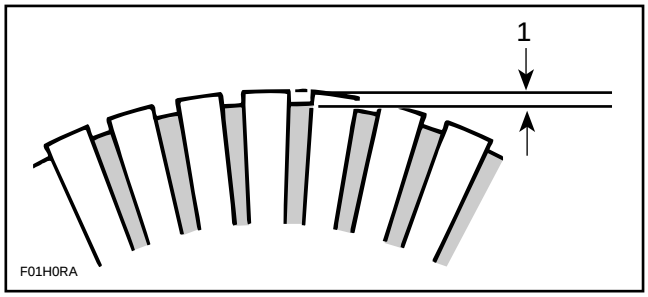
Armature

○ NOTE : An ohmmeter may be used for the following testing procedures, except for the one concerning shorted windings in armature.

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Check commutator for roughness, burnt or scored surface. If necessary, turn commutator on a lathe, enough to resurface only.

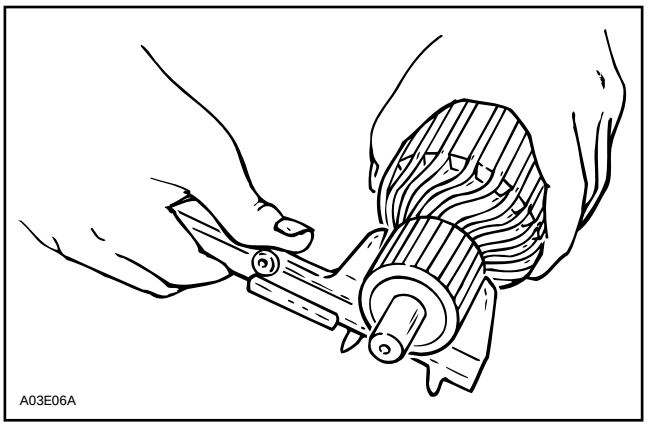
Check commutator for mica depth. If depth is less than 0.20 mm (.008 in), undercut mica. Be sure that no burrs are left and no copper dust remains between segments after undercutting operation is completed.



1. Commutator undercut 0.20 mm (.008 in)

Check commutator out of round condition with V-shaped blocks and an indicator. If commutator out of round is more than 0.40 mm (.016 in), commutator should be turned on a lathe.

Check commutator outer diameter. If less than 27 mm (1.063 in), replace.



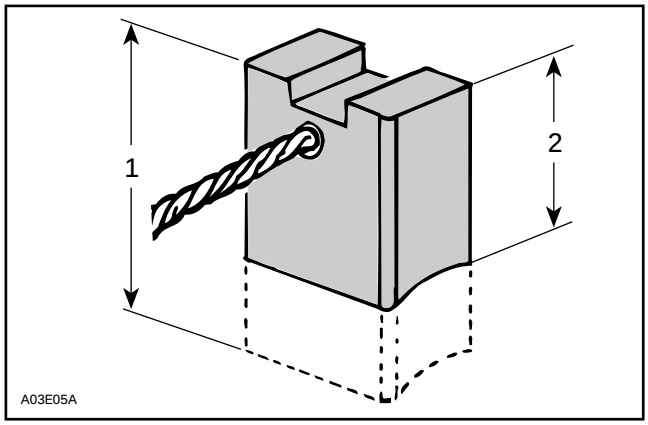
Brush Holder

Check brush holder for insulation using an ohmmeter. Place one test probe on insulated brush holder and the other test probe on brush holder plate. If continuity is found, brush holder has to be repaired or replaced.

Brush Length

Measure brush length. If less than 8.5 mm (.335 in), replace them.

NOTE : .New brush length is 12 mm (.472 in).



1. New
2. Wear limit, 8.5 mm (.335 in)

Overrunning Clutch

Pinion of overrunning clutch should turn smoothly in clockwise direction, and should not slip in a counterclockwise direction. If defective, replace.

Check pinion teeth for wear and damage. If defective, replace.

NOTE : Always check engine ring gear teeth for wear and damage. If defective replace ring gear. Refer to ELECTRICAL SYSTEM 08-01.

STARTER ASSEMBLY

Reverse the order of disassembly to reassemble starter. However, attention should be paid to the following operations.

Prior to assembling, coat sliding surfaces on armature shaft splines, overrunning clutch and bushing with G.E. Versilube G 341 M or ESSO Beacon 325 lubricant or equivalent.

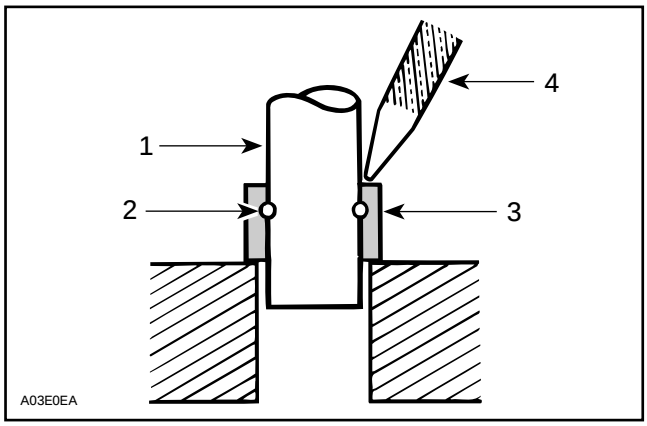
Apply motor oil on metal bushings.

6,8, Circlip and Pinion Stop Collar

After placing stop collar on armature shaft, fit circlip into armature shaft, then make sure that it is properly secured.

Slide stop collar over circlip and secure in place by punching it at 2 or 3 places.

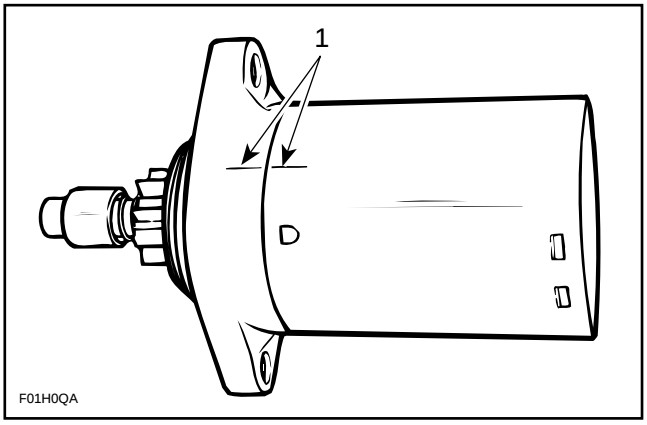
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1. Armature shaft
2. Circlip
3. Pinion stop collar
4. Punch

1,10, Housing and Yoke Ass'y

Align previously traced indexing marks.

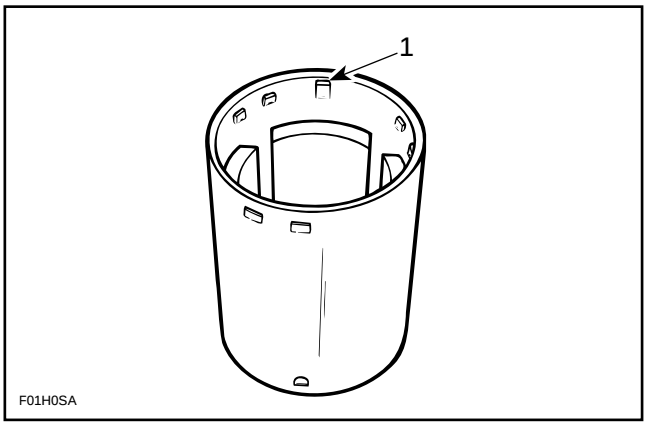


TYPICAL
1. Align marks

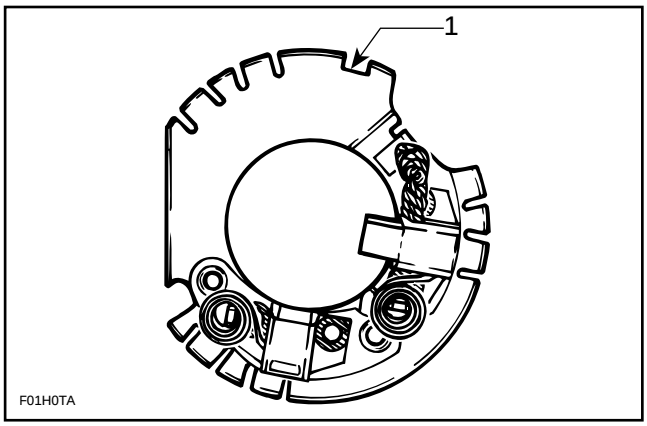
1,3,4, Yoke Ass'y, End Frame and Through Bolt

Open brushes and slide over commutator.

Align end frame locating notch with yoke locating protrusion and properly sit brush holder into yoke.



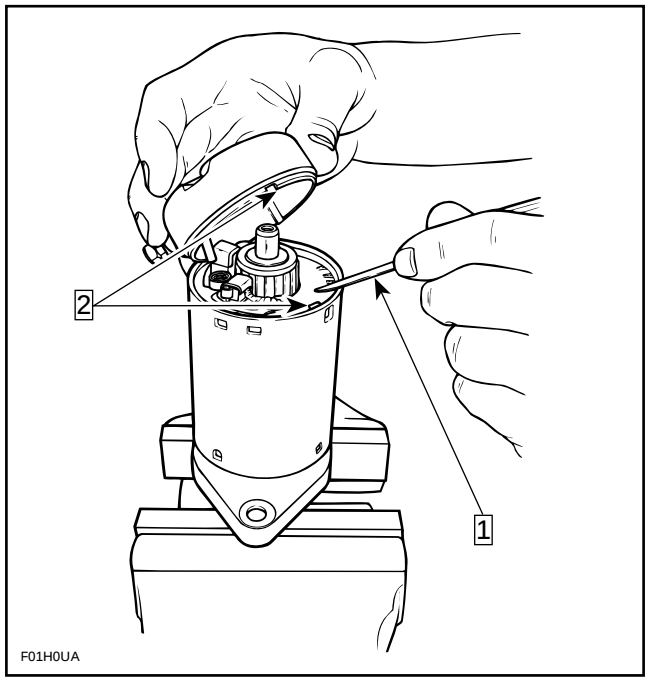
1. Locating protrusion is the higher one



1. Brush holder locating notch

To ease end frame installation, retain brush holder with a small screwdriver while installing end frame.

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Step 1 Retaining brush holder with a screwdriver
Step 2 Align here

Align end frame notch with brush holder notch / yoke protrusion.

CAUTION : Make sure end frame fits perfectly on yoke.

STARTER INSTALLATION

Installation is essentially the reverse of removal procedure. However, pay particular attention to the following.

Make sure that starter and engine mating surfaces are free of debris. Serious trouble may arise if starter is not properly aligned.

13,14, Screw

Torque starter screws to 22 N•m (16 lbf•ft).

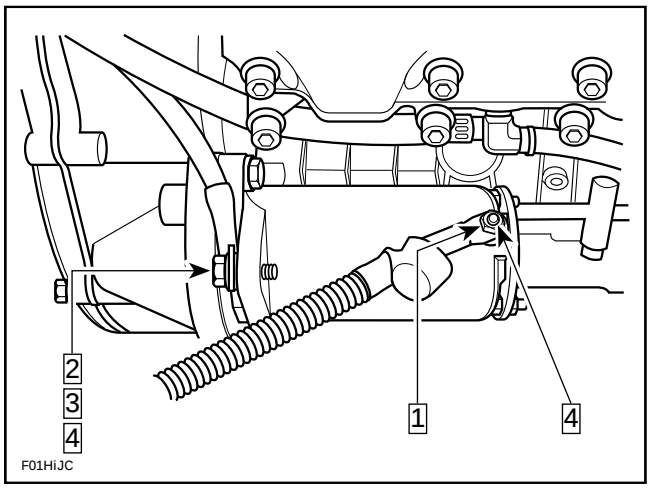
15, Nut

Connect the RED battery cable to the starter and torque nut to 6 N•m (53 lbf•in). Apply dielectric grease on terminal and nut.

16,17, Screw and Teeth Washer

Apply Loctite 271 (red) on screw.

Connect BLACK cable to starter using flat washer, teeth washer and screw. Torque screw to 22 N•m (16 lbf•ft). Apply dielectric grease on terminal and screw.



Step 1 Torque nut to 6 N•m (53 lbf•in)
Step 2 Apply Loctite 271 on screw
Step 3 orque screw to 22 N•m (16 lbf•ft)
Step 4 Apply dielectric grease

WARNING : Always connect RED positive cable first then BLACK negative cable last. Whenever connecting the RED positive cable to the starter motor make sure the battery cables are disconnected to prevent electric shock.

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STARTER SPECIFICATION

Nominal output		0.6 kW		
Voltage		12 V		
Rated time		30 seconds		
Rotation		Counterclockwise (viewed from pinion side)		
Weight		Approx. 2 kg (4.4 lb)		
Performance Specification at 20 °C (68 °F)	No load	11.5 V	20 A max.	5500 RPM
	Load	8.5 V	170 A max.	2200 RPM
	Stall	5 V	350 A max.	0 RPM
Battery		19 Ah		

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INSTRUMENTS AND ACCESSORIES

GENERAL

It is possible to activate the fuel gauge / low oil warning light, multifunction gauge or VTS gauge when the engine is not running.

Make sure the safety lanyard is removed, then depress the start / stop button.

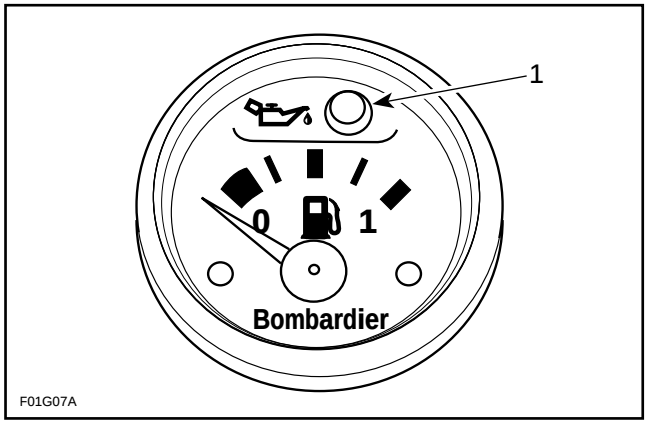
The gauge(s) will be activated during 33 seconds : the time the delay timer of the MPEM will stay on.

INSPECTION

Fuel Gauge / Low Oil Warning Light

The fuel gauge has a pointer which indicates fuel level in the tank.

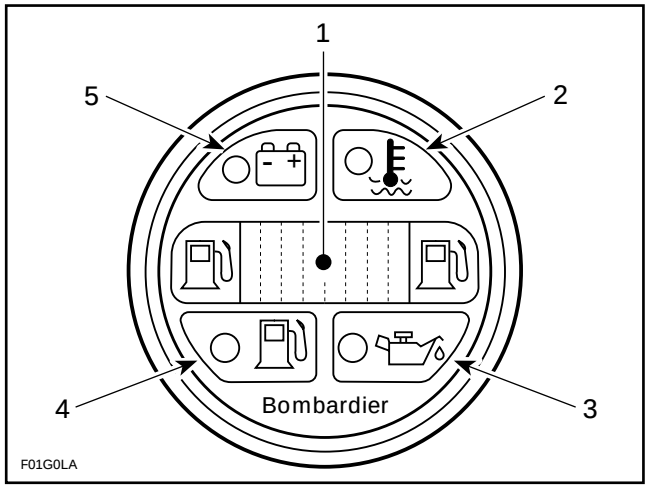
The low oil warning light is part of the gauge. It will light when injection oil level is low.



1. Low oil warning light

Multifunction Gauge

A LCD gauge indicates the amount of fuel in the tank. Warning lights will indicate a defective charging system, an overheating engine, low fuel level and low oil level.

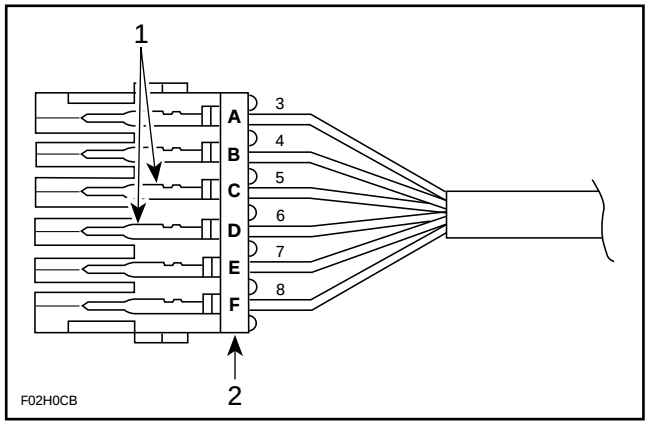


1. Fuel level bar graph
2. Engine overheats
3. Low oil level
4. Low fuel level
5. Low voltage

Accuracy of gauge can be checked with a potentiometer.

– Disconnect 6-circuit tab housing of gauge.

– Using an appropriate terminal remover, remove PINK / BLACK and PINK wires from tab housing.



1. Remove wires
2. Tab housing
3. PURPLE
4. BLACK
5. PINK
6. PINK / BLACK
7. BLUE
8. BLUE / BLACK

– Reconnect tab housing of gauge.

– Connect potentiometer test probes to PINK / BLACK and PINK wires of gauge.

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– Adjust potentiometer to the resistance values as per following chart to test accuracy of gauge.

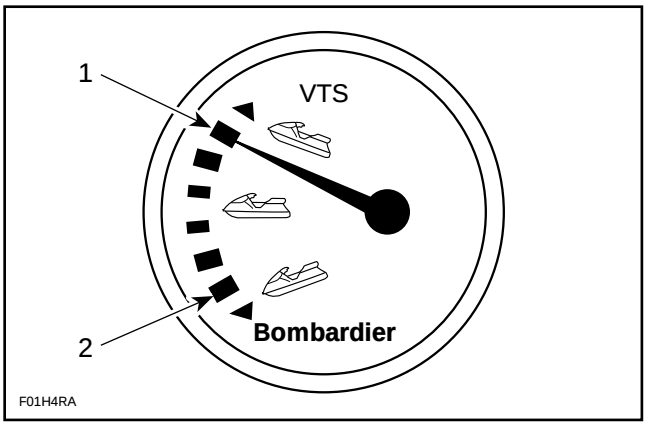
NOTE : Gauge must be activated to obtain a reading.

RESISTANCE (Ω)	FUEL LEVEL LCD GRAPHIC	LOW FUEL LEVEL RED LIGHT
0 ± 2.2 0	FULL	OFF
17.8 ± 2.2	7/8	OFF
27.8 ± 2.2	3/4	OFF
37.8 ± 2.2	5/8	OFF
47.8 ± 2.2	1/2	OFF
57.8 ± 2.2	3/8	OFF
67.8 ± 2.2	1/4	OFF
77.8 ± 2.2	1/8	ON
89.0 ± 2.2	EMPTY	ON

If gauge is not within the specifications, replace it.

Variable Trim Gauge

The trim gauge shows the riding angle of the watercraft.



1. Bow up
2. Bow down

Accuracy of gauge can be checked with a potentiometer.

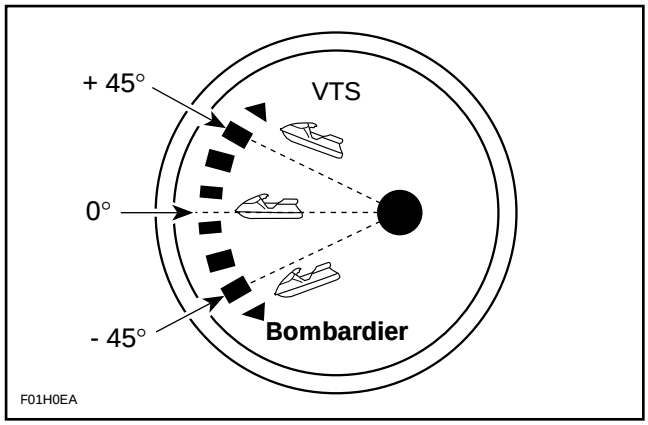
– Disconnect 2-circuit connector housing of BROWN / BLACK and BROWN / WHITE wires of gauge.

– Connect potentiometer test probes to BROWN / BLACK and BROWN / WHITE wires of gauge.

– Adjust potentiometer to the resistance values as per following chart to test accuracy of gauge.

NOTE : Gauge must be activated to obtain a reading.

RESISTANCE (Ω)	GAUGE NEEDLE POSITION
10	-45°
95	0°
180	+ 45°

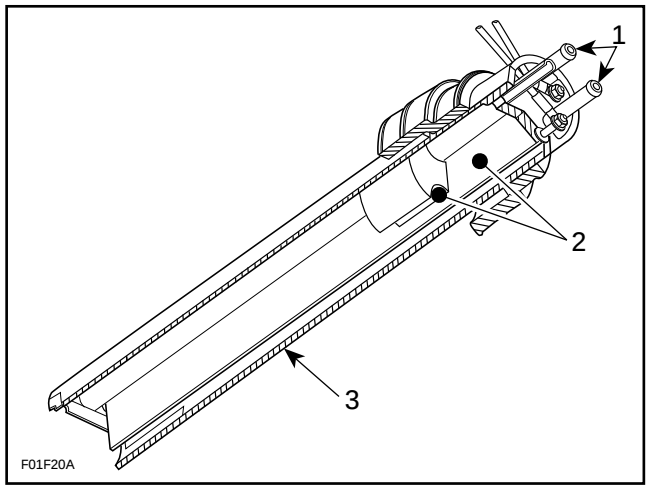


If gauge is not within the specifications, replace it.

Fuel Baffle Pick-Up Sensor

The baffle pick-up has an integrated fuel sensor (except SP and HX models).

To verify fuel sensor, a resistance test should be performed with an ohmmeter allowing the float to move up through a sequence.



1. Pick-up tube
2. Fuel sensor
3. Baffle pick-up

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The resistance measured between PINK / BLACK and PINK wires must be in accordance with fuel level (measured from under the flange) as specified in the following charts.

FUEL LEVEL AND RESISTANCE (SPI, SPX, XP)	
FUEL LEVEL (mm)	RESISTANCE (Ω)
From 206.1 ± 5 and more	0 ± 2.2 0
From 189.1 @ 206 ± 5	17.8 ± 2.2
From 162.1 @ 189 ± 5	27.8 ± 2.2
From 135.1 @ 162 ± 5	37.8 ± 2.2
From 108.1 @ 135 ± 5	47.8 ± 2.2
From 81.1 @ 108 ± 5	57.8 ± 2.2
From 54.1 @ 81 ± 5	67.8 ± 2.2
From 40.1 @ 54 ± 5	77.8 ± 2.2
From 0 @ 40 ± 5	89.8 ± 2.2

FUEL LEVEL AND RESISTANCE (GTS, GTI)	
FUEL LEVEL (mm)	RESISTANCE (Ω)
From 257.9 ± 5 and more	0 ± 2.2 0
From 234.4 @ 257.8 ± 5	17.8 ± 2.2
From 200.9 @ 234.3 ± 5	27.8 ± 2.2
From 167.4 @ 200.8 ± 5	37.8 ± 2.2
From 134 @ 167.3 ± 5	47.8 ± 2.2
From 100.5 @ 133.9 ± 5	57.8 ± 2.2
From 67 @ 100.4 ± 5	67.8 ± 2.2
From 40.1 @ 66.9 ± 5	77.8 ± 2.2
From 0 @ 40 ± 5	89.8 ± 2.2

Oil Sensor

The sensor sends the signal to the low-oil level light in the fuel gauge.

The bottom of the sensor has a small reservoir with two small holes underneath to let the oil enter inside and one at the top to let the air enter allowing the oil to flow out.

When there is enough oil inside the oil tank (and therefore in the sensor reservoir), the sensor detects the liquid and the light DOES NOT turn on.

When the oil level goes at critical LOW level inside the oil tank (and therefore in sensor reservoir), the sensor detects the absence of liquid and the light TURNS ON.

To check the oil sensor, unplug its connector and pull sensor out of oil tank.

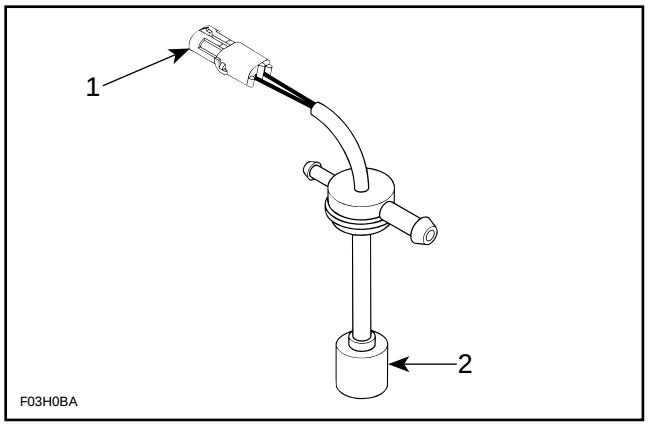
Using an ohmmeter, check the continuity between the BLUE and BLUE / BLACK terminals.

When sensor is out of oil tank and its reservoir is empty, resistance must be infinite (open circuit).

NOTE : Wait about 15-20 seconds before taking any reading to give the oil enough time to flow out or inside sensor reservoir.

Soak sensor in oil so that its reservoir fills up. Maximum resistance should be approximately 2 Ω (closed circuit).

TEST CONDITION	READING (Ω)
Sensor OUT of oil.	∝(open circuit)
Sensor soaked IN oil.	2 Ω max. (closed circuit)



1. Measure resistance here
2. Sensor reservoir

To reinstall sensor :

– Remove rubber seal from sensor.
– Install seal in oil tank hole.
– Push sensor in seal.
– Plug connector.

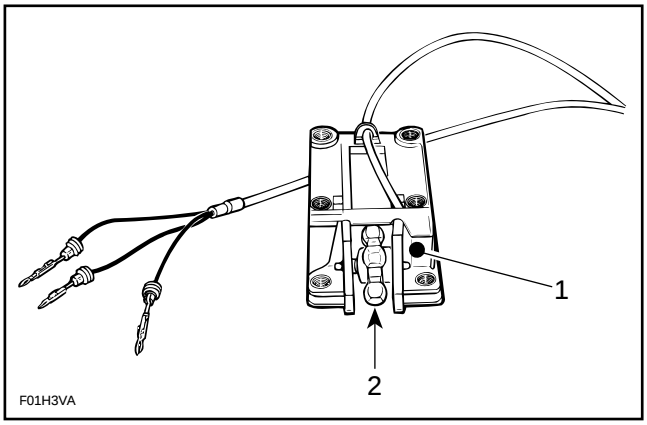
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NOTE : This sensor turns the low-level oil light to ON if the connector has been forgotten unconnected even when there is enough oil in tank.

Speed Sensor

The speedometer gives a reading through a speed sensor. Speed sensor is installed on ride shoe. It works with the water flow which turns a magnetic paddle wheel that triggers an electronic pick-up that in turn sends a speed signal to the speedometer.

The paddle wheel is protected by the pick-up housing.



1. Pick-up housing
2. Paddle wheel

STATIC TEST

To verify speed sensor, a resistance test can be performed with an ohmmeter. Disconnect speed sensor wires from inside bilge.

Refer to the following chart for speed sensor testing. Always respect polarity in chart.

METER (-) LEAD	METER (+) LEAD	APPROX. VALUE
Purple/Yellow	Black	∝
Black	Purple/Yellow	21.8 MΩ
Blue/Purple	Black	3.6 MΩ
Black	Blue/Purple	∝
Purple/Yellow	Blue/Purple	∝
Blue/Purple	Purple/Yellow	3 MΩ

DYNAMIC TEST

To verify speed sensor, a dynamic test can also be performed using a battery and a voltmeter.

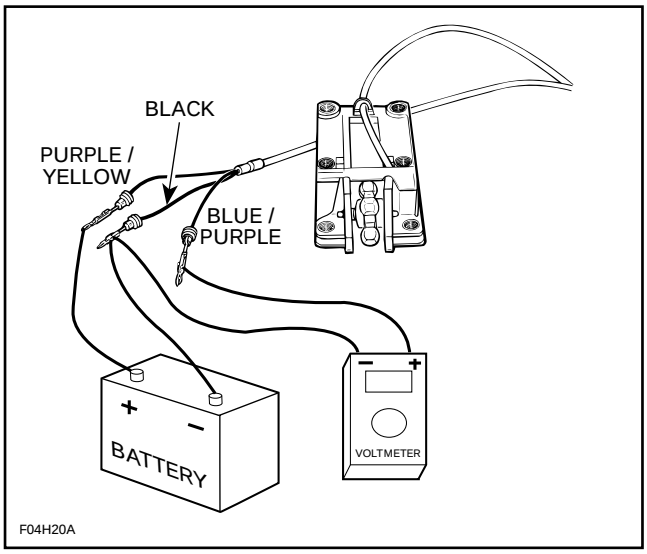
Disconnect speed sensor wires from inside bilge.

With a 12 VDC battery, connect the positive (+) to sensor PURPLE / YELLOW wire.

Connect the negative (-) to the sensor BLACK wire.

Connect the voltmeter positive probe to sensor BLUE / PURPLE wire and the negative probe to sensor BLACK wire.

Turn the paddle wheel slowly. There should be a voltage fluctuation.



VTS Switch

Always confirm first that the fuse is in good condition.

Disconnect BLACK wire, BLUE / WHITE wire and GREEN / WHITE wire of VTS switch located in front of bilge on left side.

Using an ohmmeter, connect test probes to switch BLACK and BLUE / WHITE wires ; then, connect test probes to switch BLACK and GREEN / WHITE wires.

Measure resistance ; in both test, it should be high when button is released and must be close to zero when activated.

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VTS Motor

Always confirm first that the fuse is in good condition.

Motor condition can be checked with an ohmmeter. Install test probes on both BLUE / ORANGE and GREEN / ORANGE wires. Measure resistance, it should be close to 1.5 ohm.

If motor seems to jam and it has not reached the end of its stroke, the following test could be performed.

First remove motor, refer to PROPULSION SYSTEM 09-04. Then manually rotate worm to verify VTS system actuating mechanism for free operation.

Connect motor through a 15 A fuse directly to the battery.

Connect wires one way then reverse polarities to verify motor rotation in both ways.

If VTS actuating mechanism is correct and the motor turns freely in both ways, VTS module could be defective.

VTS Control Module

It receives its current from the battery. It is protected by its own 7.5 A fuse.

RESISTANCE TEST

Disconnect BROWN / BLACK wire and BROWN / WHITE wire of VTS control module located in front of bilge on left side.

Connect test probes of an ohmmeter to BROWN /BLACK wire and BROWN / WHITE wire of VTS control module.

NOTE : To permit VTS actuation when engine is not running, remove safety lanyard from switch and depress start / stop button to activate delay timer.

Push on VTS switch down position until motor stops.

Read the resistance on the ohmmeter, it should indicate a resistance of 24 ohms ± 1%.

Push on VTS switch up position until motor stops.

Read the resistance on the ohmmeter, it should indicate a resistance of 167 ohms ± 1%.

For a complete resistance test from UP to DOWN position, refer to the following chart.

NOTE : If the VTS control module passes this resistance test, it doesn't mean it is in perfect condition.

RESISTANCE (Ω)	NOZZLE POSITION
167.3 ± 1 %	UP
153.0 ± 4 %	
138.7 ± 1 %	
124.4 ± 1 %	
110.1 ± 1 %	
95.8 ± 1 %	
81.5 ± 1 %	
67.2 ± 1 %	
52.9 ± 1 %	
38.6 ± 1 %	
24.3 ± 1 %	DOWN

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DIGITALLY ENCODED SECURITY SYSTEM

GENERAL

The Digitally Encoded Security System (DESS) features an anti-start protection against unauthorized use of the watercraft.

The following components are specially designed for this system : Multi-Purpose Electronic Module (MPEM), safety lanyard cap and safety lanyard switch.

The safety lanyard cap has a magnet and a ROM chip. The chip has a unique digital code.

The DESS circuitry in the watercraft MPEM is activated at the factory. Therefore, a safety lanyard must be programmed to start the engine.

NOTE : Actually, it is the memory of the MPEM which is programmed to recognize the digital code of the safety lanyard cap. This is achieved with the MPEM programmer (P / N 295 000 127). Refer to its guide to program a safety lanyard.

The system is quite flexible. Up to eight safety lanyards may be programmed in the memory of the watercraft MPEM. They can also be erased.

NOTE : If desired, a safety lanyard can be used on any watercraft equipped with the DESS.

The memory of the MPEM is permanent. If the battery is disconnected, no information is lost.

The memory of the MPEM has also two self-diagnostic modes.

When ordering a new MPEM from the regular parts channel, the DESS circuitry will not be activated. If desired, it can be activated with the MPEM programmer.

NOTE : If the DESS circuitry of the watercraft MPEM is not activated, engine can be started with any safety lanyard. Once the DESS circuitry is activated, it is not possible to deactivate it. A safety lanyard must be programmed to start the engine.

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Basic Self-Diagnostic Mode

It is self-activated when the safety lanyard is being installed on the watercraft switch. It gives immediate monitoring. Some codes may occur only when pressing the start / stop button. Refer to the following chart.

SIGNAL	CAUSE	REMEDY
2 short beeps (while installing safety lanyard on watercraft switch)	• Everything is correct with the safety lanyard (good contact and right lanyard cap).	• Engine can be started normally.
1 long beep (while installing safety lanyard on watercraft switch or when pressing start/stop button in some cases)	• Bad connection between saafety lanyard cap and switch.	• Push and turn the safety lanyard on the switch until 2 short beeps are heard to indicate the system is ready to allow engine starting.
	• Wrong safety lanyard.	• Use the safety lanyard that has been programmed for the watercraft.If it does not work, check safety lanyard condition with the programmer. Replace safety lanyard if reported defective. If it still does not work, enable more detail about the failure.
	• Salt water in safety lanyard cap.	• Clean safety lanyard cap to remove salt water.
	• Improper operation of MPEM or defective wiring harness.	• Enable advanced diagnostic mode to obtain more detail about the failure.
4 long beeps (while installing safety lanyard on watercraft switch)	• Watercraft MPEM can not communicate with the DC-CDI module (XP model only)	• Check fuse on relay located in the conventional electrical box. • Check connector between MPEM and DC-CDI modules.
8 short beeps	• Defective MPEM (memory)	• Replace MPEM
Continuous beep	• Engine overheating.	• Refer to TROUBLESHOOTING 03-00.

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Advanced Self-Diagnostic Mode

It needs to be enabled manually. Proceed as follows :

1. Remove safety lanyard from watercraft switch.
2. Press 5 times on the watercraft start / stop button.

NOTE : 1 short beep and 1 long beep must be heard. They validate beginning of diagnostic mode.

3. Install safety lanyard on watercraft switch.
4. Press the watercraft start / stop button again.

NOTE : If everything is correct, engine will start. Otherwise, refer to the following chart.

SIGNAL	CAUSE	REMEDY
No beep	• Engine actually starts.	• Everything is correct.
1 long and 1 short beeps	• No safety lanyard has ever been programmed in watercraft MPEM.	• Use programmer and program a safety lanyard. This code can occur only when you receive a new MPEM from the factory and no key has ever been programmed.
2 short beeps	• MPEM can not read the digital code of the safety lanyardcap or the magnet is defective. • Mixed wires at safety lanyard switch connectors or bad connections.	• Check safety lanyard cap condition with the MPEM programmer. Replace safety lanyard if reported defective. • Check switch wiring harness.
2 long beeps	• Wrong safety lanyard or bad connection of the DESS wires.	• Use the safety lanyard that has been programmed for the atercraft. If the problem is not resolved, check safety lanyard cap condition with the MPEM programmer. Replace safety lanyard if reported defective.
3 short beeps	• Wiring harness of DESS switch is grounded or there is a short circuit.	• Check wiring harness and safety lanyard switch.

If you need to listen again the coded beeps, remove safety lanyard and repeat the procedure to activate the diagnostic mode.

If there is more than one problem, the MPEM will send only one error code. When the problem is solved, the MPEM will send a second code and so on until all problems are resolved.

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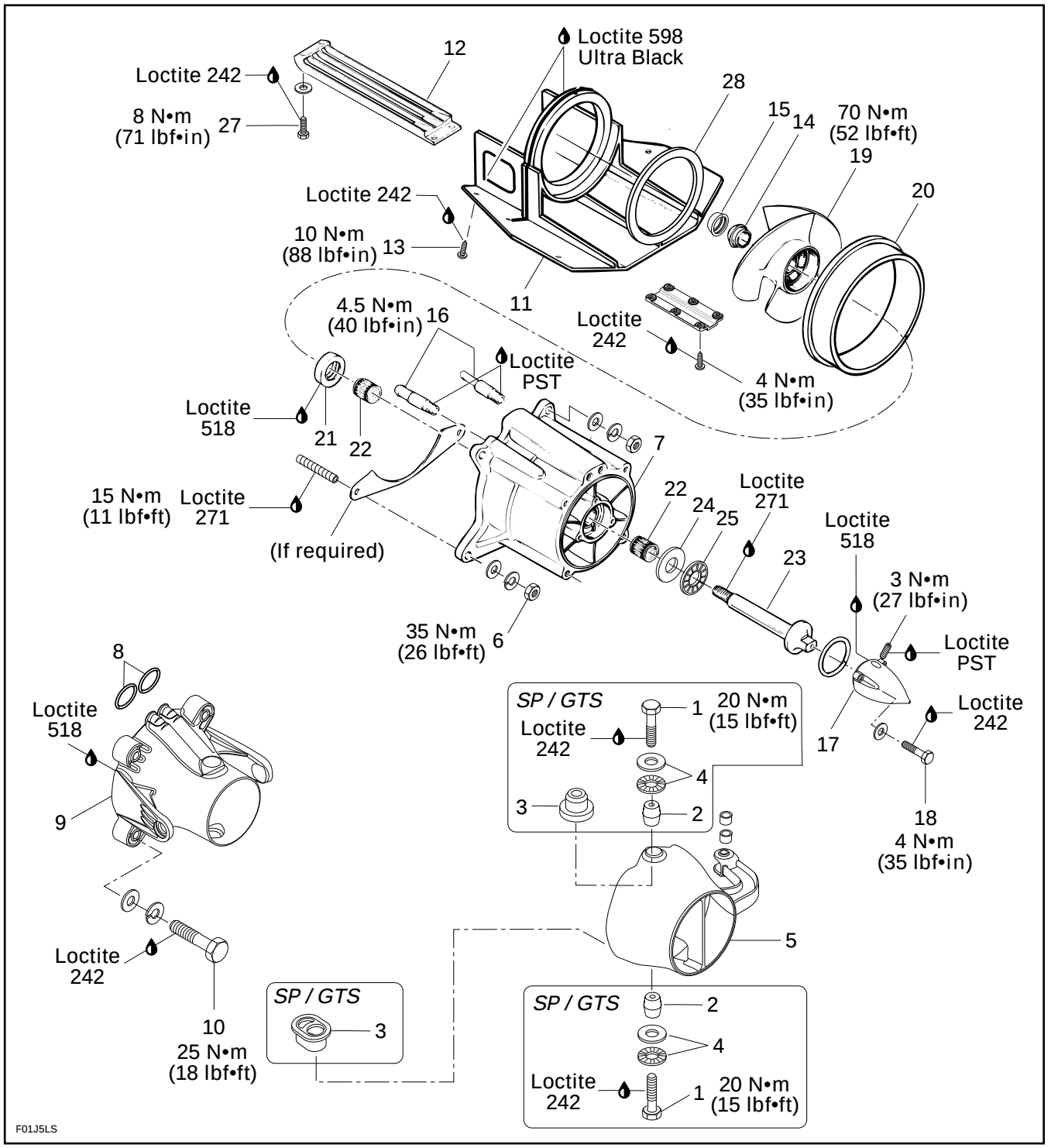
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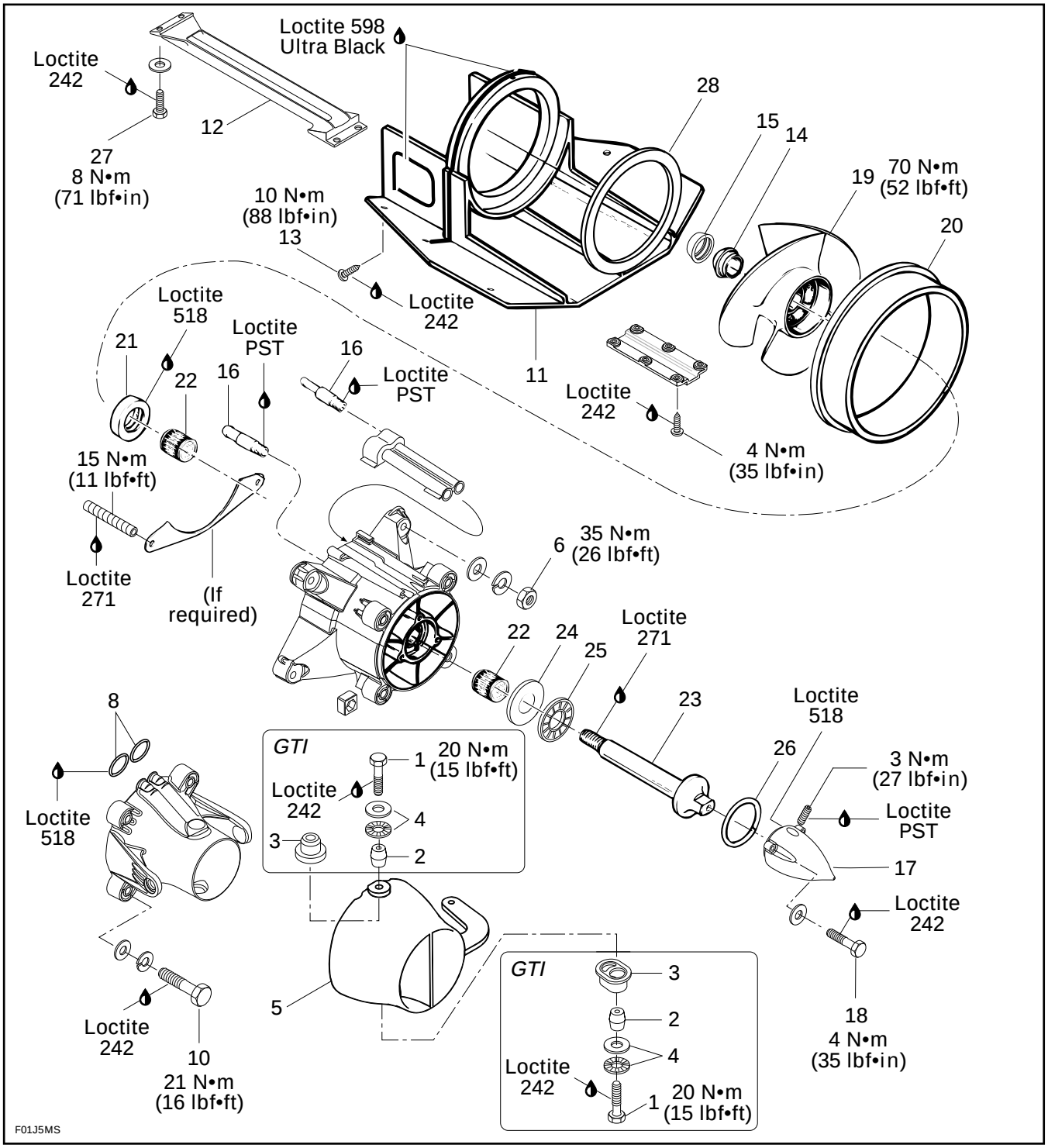
JET PUMP

ALUMINUM PUMP



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PLASTIC PUMP



PARTS
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GENERAL

The impeller housing, venturi and nozzle are either made of aluminum or plastic, depending on which model of watercraft.

Plastic is a light weight material and it is not affected by corrosion.

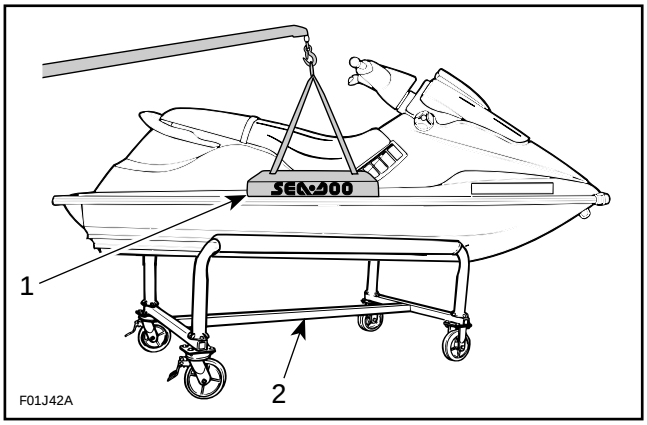
All watercraft powered by a 717 or 787 engines have a stator made of bronze which offers greater strength than aluminum.

JET PUMP INSPECTION ON WATERCRAFT

To work on watercraft, securely install it on a stand. Thus, if access is needed to water inlet area, it will be easy to slide underneath watercraft. Working on the water intake grate, jet pump, ride shoe, etc., can be done by simply blocking the rear of watercraft above work stand.

A lift kit can be used to install watercraft on a stand. Refer to the following chart.

LIFT KIT P / N	WATERCRAFT MODEL
295 100 012	SP / XP series and HX
295 100 013	GTS / GTI models

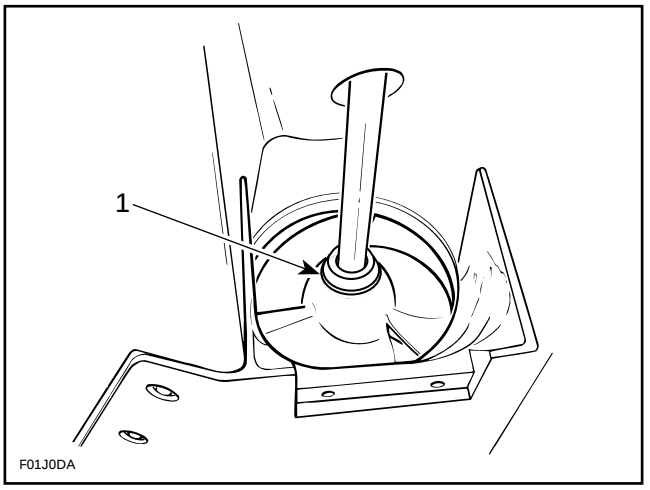


1. Lift kit
2. Work stand

Impeller Condition and Impeller / Wear Ring Clearance

Impeller Condition

Condition of impeller, boot and ring can be quickly checked from underneath of the watercraft. Remove grate and look through water inlet opening.



1. Boot with ring

Impeller / Wear Ring Clearance

This clearance is critical for jet pump performance.

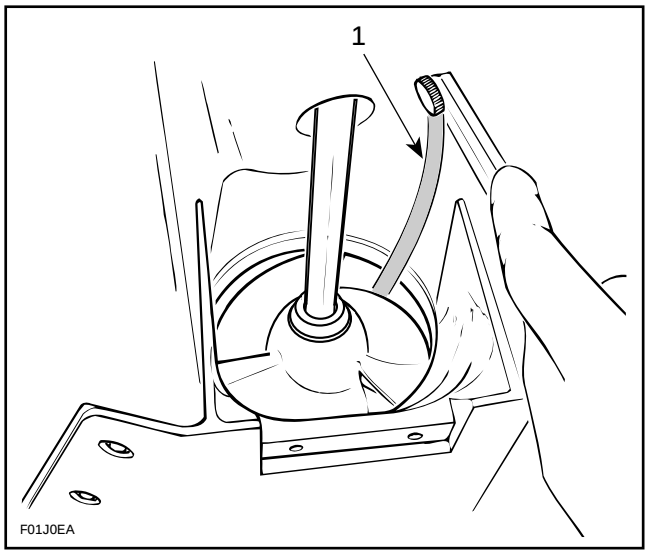
Clearance can be checked from water inlet opening or from venturi side. However, the last method requires more work.

To check clearance from water inlet side remove inlet grate.

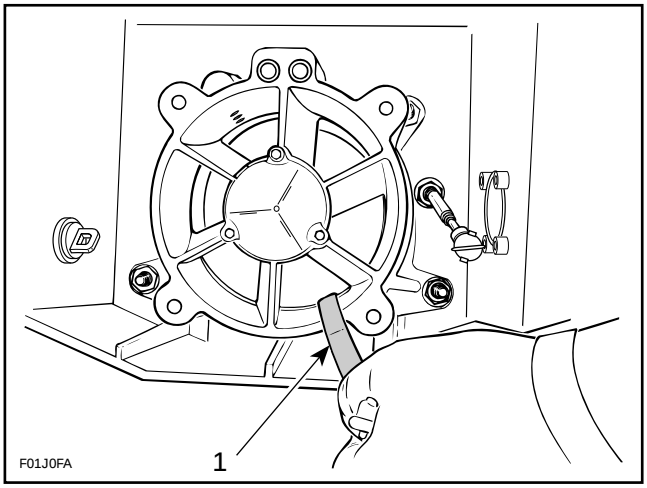
To check clearance from venturi side, remove venturi /nozzle assembly as described in Oil Inspection in this section.

Using a feeler gauge with 30 cm (12 in) blades, measure clearance between impeller blade tip and wear ring. Measure each blade at its center. Clearance should not exceed 1.0 mm (.040 in). If clearance is greater, disassemble jet pump and inspect impeller and wear ring. Renew worn parts.

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MEASURING FROM WATER INLET SIDE
1. Feeler gauge



MEASURING FROM VENTURI SIDE
1. Feeler gauge

Oil Inspection

Venturi Removal

Detach ball joint of steering cable from nozzle.

Detach ball joint of VTS from trim ring (SPX / XP models).

Remove nut of manual trim from trim ring (SPI / HX models)

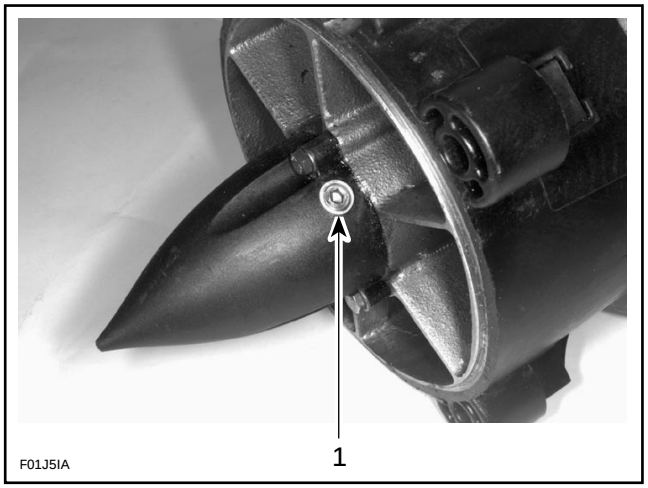
Detach ball joint of reverse cable and springs from reverse gate (GTS / GTI models).

Remove 4 retaining screws from venturi.

Pull venturi and nozzle assembly from impeller housing.

Oil Check

Remove housing cover plug.



TYPICAL
1. Remove plug

Check oil level, it should be at bottom of hole threads.

If oil level is low, check impeller shaft housing for leaks. A pressure test must be performed. Refer to PUMP PRESSURIZATION in this section.

To check oil condition, insert a wire through oil level hole then withdraw. A whitish oil indicates water contamination.

This may involve defective impeller shaft seal and / or O-ring of housing cover. Jet pump unit should be overhauled to replace seal.

If everything is correct, apply Loctite PST 592 on plug and reinstall it on cover. Properly reinstall removed parts.

Oil Replacement

Remove venturi / nozzle assembly as described in Oil Inspection.

Remove 3 screws retaining cover.

Using a fiber hammer, gently tap cover to release it from housing cover.

Thoroughly clean reservoir and inside of cover with a solvent. Check O-ring condition. Replace as necessary.

Apply a thin layer of Loctite 518 on mating surface of cover and reinstall it with its O-ring. Torque screws to 4 N•m (35 lbf•in).

Remove plug from cover.

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Pour approximately 90 mL (3 oz) of oil through hole until oil reaches the bottom of hole threads. Use SEA-DOO JET PUMP SYNTHETIC OIL (P / N 293 600 011) only. Oil will drain slowly into center area of housing, wait a few minutes and readjust oil level.

▼ CAUTION : This is a synthetic oil. Do not mix with mineral based oil. Do not mix oil brands.

Apply Loctite PST 592 on plug and reinstall it on cover.

Properly reinstall removed parts.

JET PUMP REMOVAL

HX Model

Disconnect steering cable from jet pump nozzle.

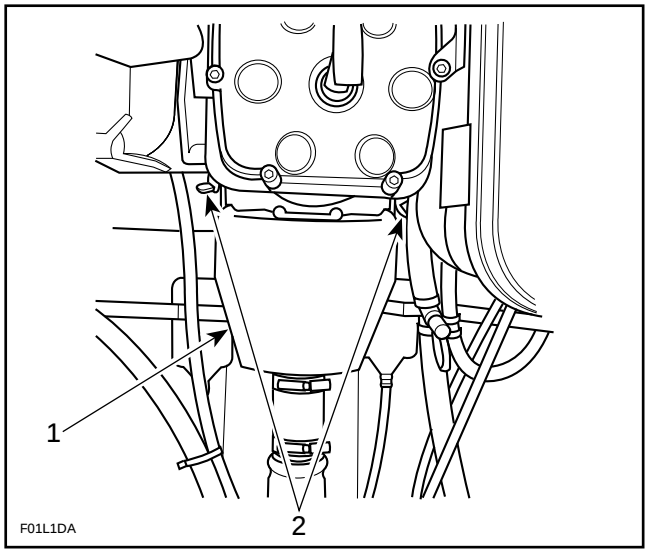
Loosen 4 hexagonal nuts and remove flat washers and lock washers from jet pump housing.

Remove jet pump.

All Models Except the HX

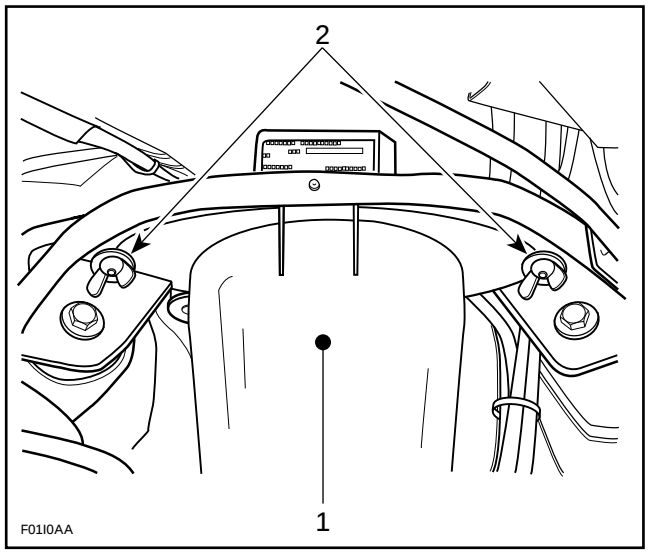
Remove air vent tube support from body opening (SP / XP series).

Remove PTO flywheel guard.



TYPICAL - ALL MODELS EXCEPT THE XP

1. *PTO flywheel guard*
2. *Wing nuts*

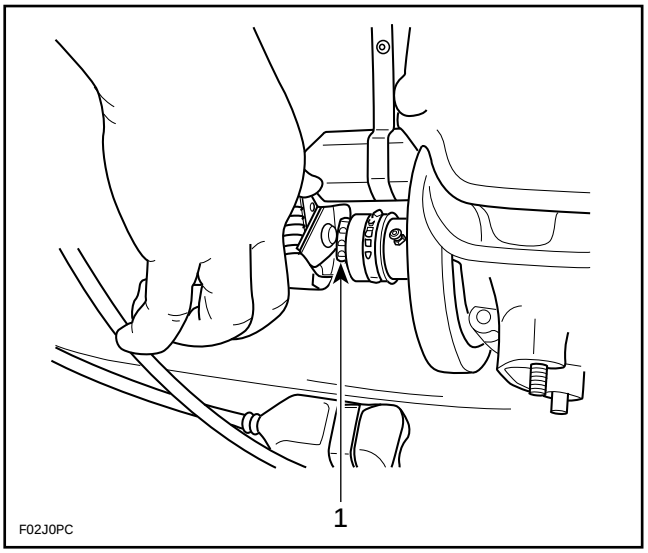


XP MODEL

1. *PTO flywheel guard*
2. *Wing nuts*

Using pliers (P / N 295 000 054), unfasten small clamp on drive shaft boot.

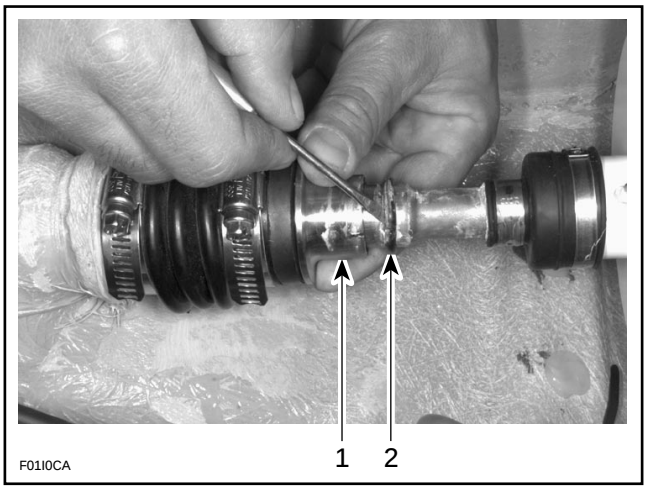
○ NOTE : If necessary, refer to PROPULSION SYSTEM 09-02.



1. *Unfasten small clamp*

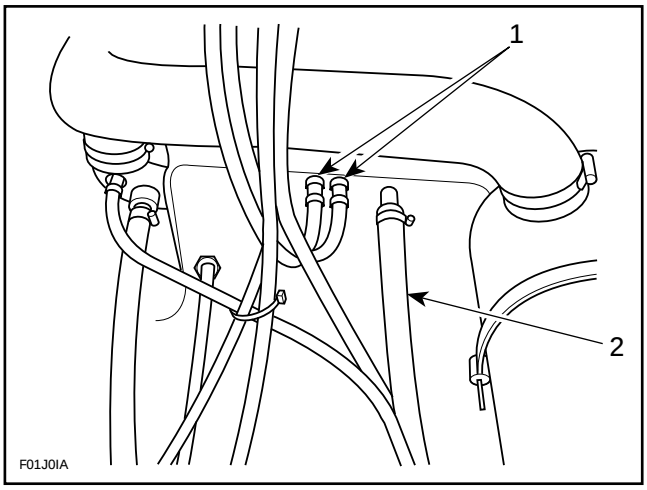
Hold floating ring and compress protective hose ; then, pull out O-ring from drive shaft groove.

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1. *Floating seal*
2. *O-ring*

Disconnect engine water inlet hose and both bailer pick-up tubes from impeller housing.



TYPICAL

1. *Bailer pick-up tubes*
2. *Engine water inlet hose*

Remove ball joint fasteners to release steering cable from nozzle.

Remove ball joint fasteners to release VTS (SPX / XP models).

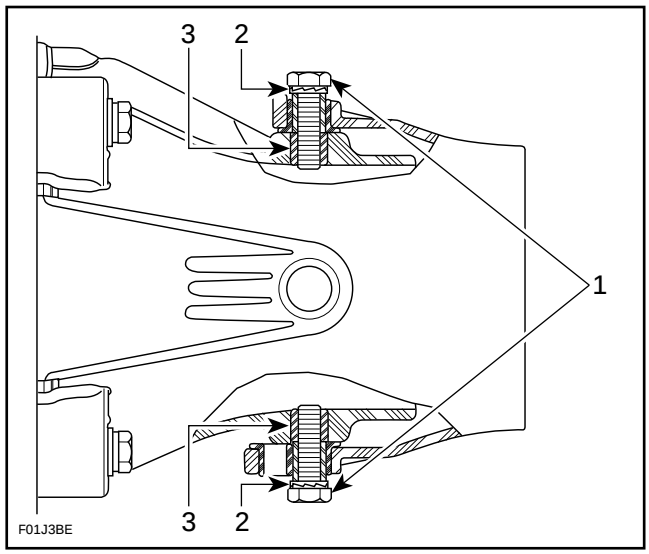
Remove nut of manual trim from trim ring (SPI and HX models).

Remove ball joint fasteners to release reverse cable from reverse gate (GTS / GTI models).

SP, GTS and GTI Models

1,2,4,5, Screw, Sleeve, Locking Disk and Nozzle

Remove 2 retaining screws, 2 sleeves, 4 locking disks and withdraw nozzle.



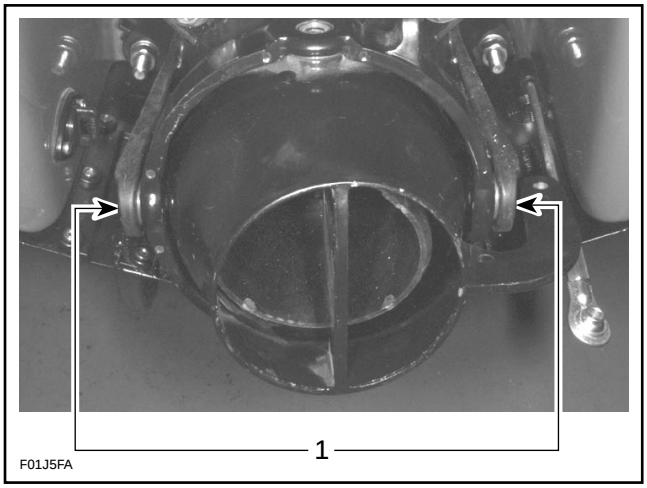
TYPICAL

1. *Screw*
2. *Locking disks*
3. *Sleeve*

SPI, SPX and XP Models

5, Nozzle

Withdraw nozzle / trim ring assembly by removing 2 retaining screws of trim ring.



1. *Remove screws*

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6,7, Nut and Impeller Housing

Remove nuts retaining impeller housing to hull.

Using screws previously removed from nozzle, install impeller housing remover tool (P / N 295 000 113) on venturi.

NOTE : It may be possible to remove jet pump without using puller.



F01J5JA

Rotate handle clockwise to remove jet pump. Withdraw pump unit and drive shaft together.

CAUTION : When removing pump unit, a shim could have been installed between hull and pump housing. Be sure to reinstall it otherwise engine and jet pump alignment will be altered.

NOTE : After jet pump removal, if drive shaft remains in PTO flywheel, simply pull it out. If drive shaft will not come out, it is probably jammed into PTO flywheel. Refer to PROPULSION SYSTEM 09-02.

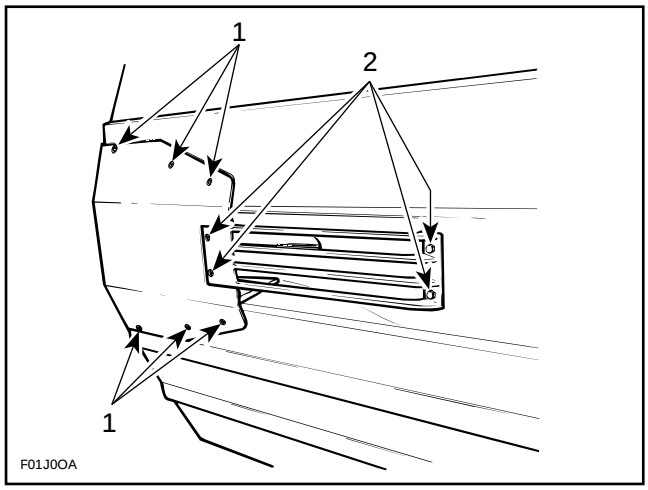
RIDE SHOE REMOVAL

11,12,13,27, Ride Shoe, Intake Grate and Screws

NOTE : Intake grate and impeller housing must be removed prior to ride shoe removal. An impact screwdriver should be used to loosen tight screws.

Remove intake grate.

Remove ride shoe screw.

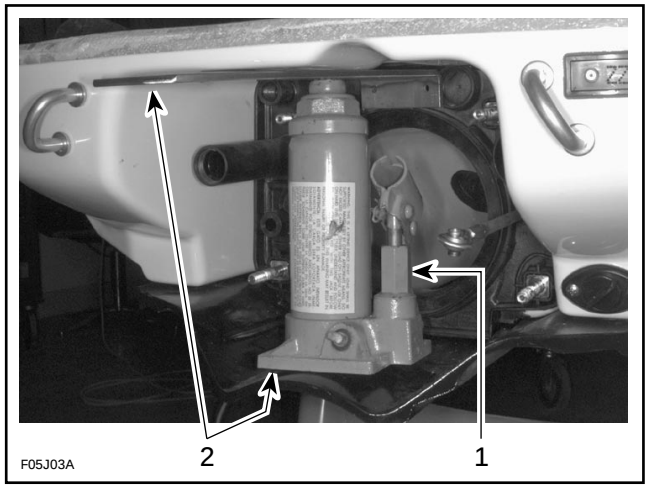


F01J0OA

TYPICAL

1. *Ride shoe screws*
2. *Intake grate screws*

Using a low height hydraulic bottle jack and two steel plates, pry out ride shoe.



F05J03A

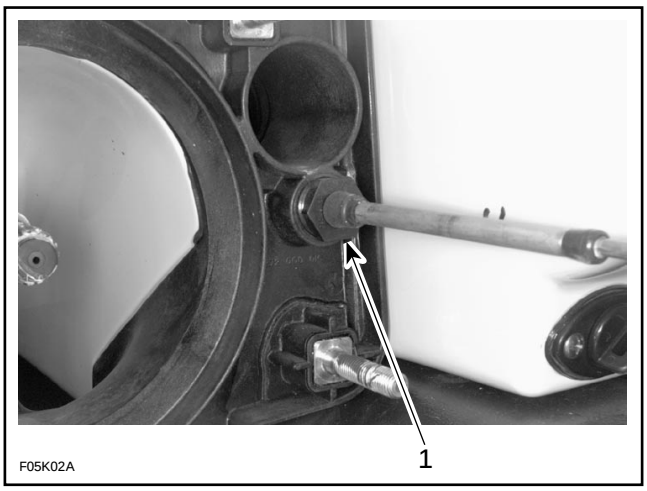
1. *Hydraulic bottle jack*
2. *Steel plate*

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JET PUMP SUPPORT REMOVAL

HX Model Only

Remove ball joint, boot, nut, half rings and O-rings from steering cable.

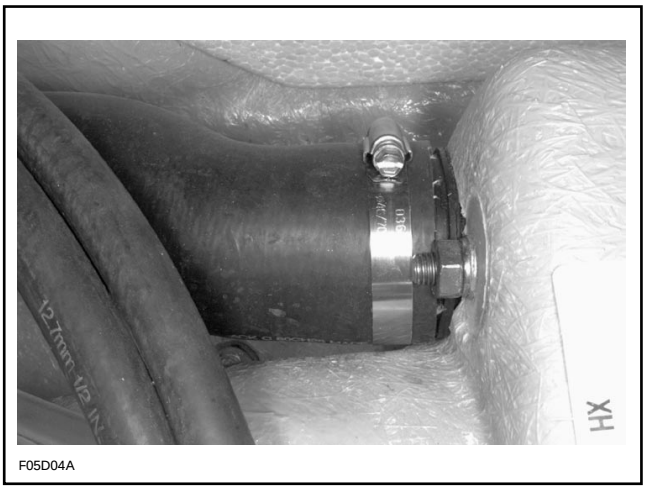


1. Unscrew nut

Disconnect water supply and water return hoses, drain hose and bailer hoses.



Disconnect exhaust hose.



Remove nuts, lock washers and flat washers retaining jet pump support.

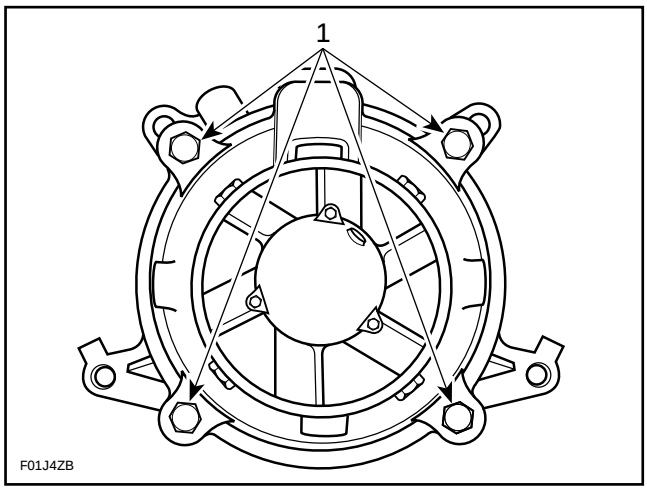
Using a heat gun, heat jet pump support until it is possible to pull it off.

JET PUMP DISASSEMBLY

NOTE : Whenever removing a part, visually check for damage such as : corrosion, crack, split, break, porosity, cavitation, deformation, distortion, heating discoloration, wear pattern, missing plating, missing or broken needles in needle bearing, water damage diagnosed by black-colored spots on metal parts, etc. Renew any damaged part. As a quick check, manually feel clearance and end play, where applicable, to detect excessive wear.

9,10, Venturi and Screw

Remove 4 retaining screws and withdraw venturi.

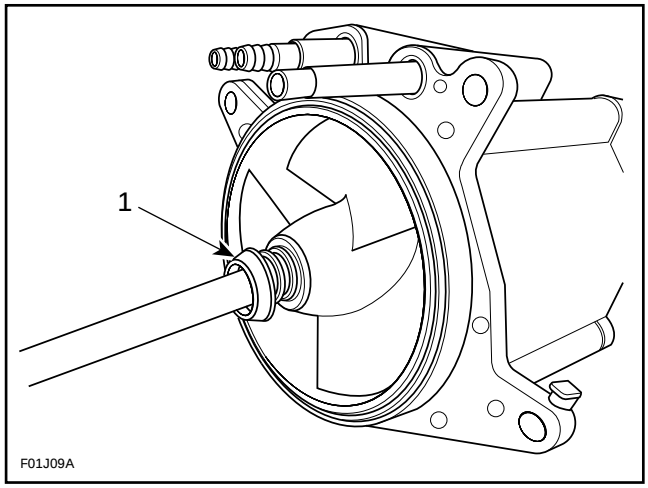


1. Remove screws

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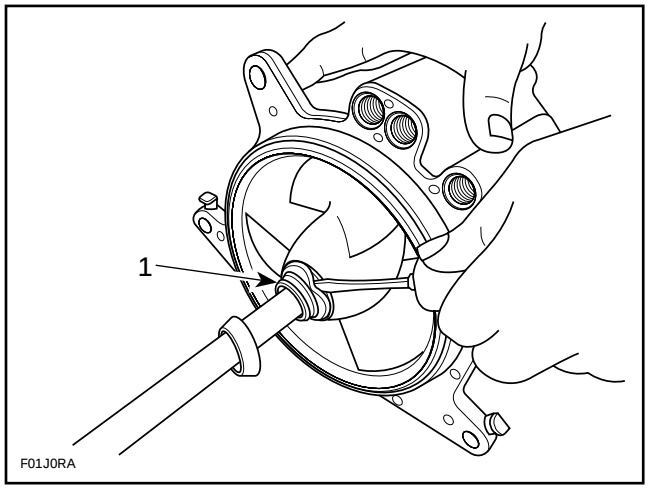
14,15, Boot and Ring

Pull out ring from boot



1. Pull out ring

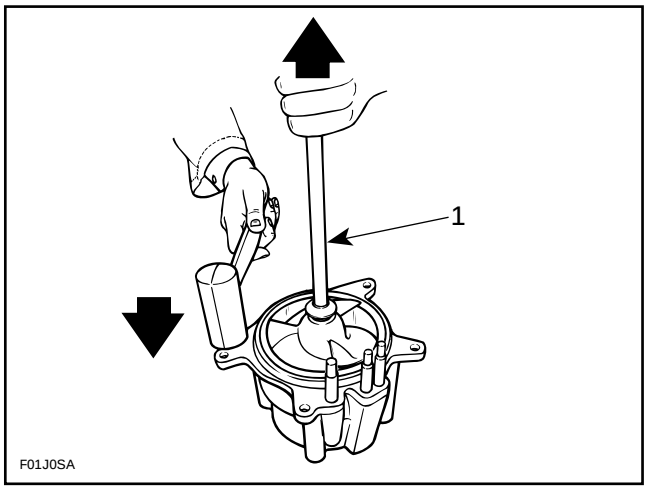
Insert a screwdriver blade between impeller and boot flange. Carefully pry boot all around to release from impeller.



1. Pry boot out

Withdraw drive shaft.

NOTE : A jammed drive shaft can be removed by holding pump unit by drive shaft, slightly raised unit above a soft surface, then strike all around impeller housing with a fiber hammer. Corroded parts can be loosened by applying BOMBARDIER LUBE lubricant (P / N 293 600 016).



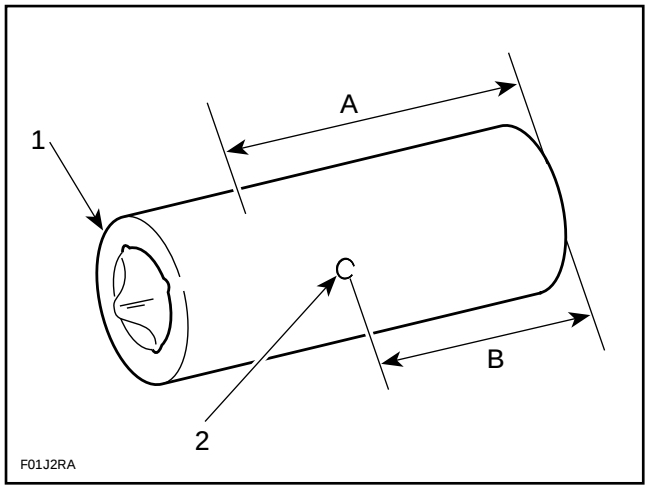
1. Hold raised with drive shaft while striking

16, Fitting

Fittings can be removed with deep socket or vise grip. Do not contact hose mounting area.

Fitting can be removed from pump housing with the following suggested tool :

– Use a 14 mm (9/16 in) deep socket.
– Drill deep socket with a 14 mm (9/16 in) drill bit, starting at hexagone head end as shown in following illustration.
– Drill a 2.40 mm (3/32 in) hole in center of deep socket as shown in following illustration.
– Install 2.40 mm (3/32 in) roll pin in the center hole.



1. Deep socket 14 mm (9/16 in)
2. Roll pin 2.40 mm (3/32 in)
A. 42.50 mm (1-43/64 in)
B. 36.80 mm (1-29/64 in)

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17,18, Housing Cover and Screw

With pump assembly in horizontal position, remove 3 retaining screws of housing cover.

Place container under cover to catch oil.

Using a fiber hammer, gently tap cover to release it from impeller housing.

19, Impeller

Insert impeller shaft holder (P / N 295 000 082) on impeller shaft flat end.

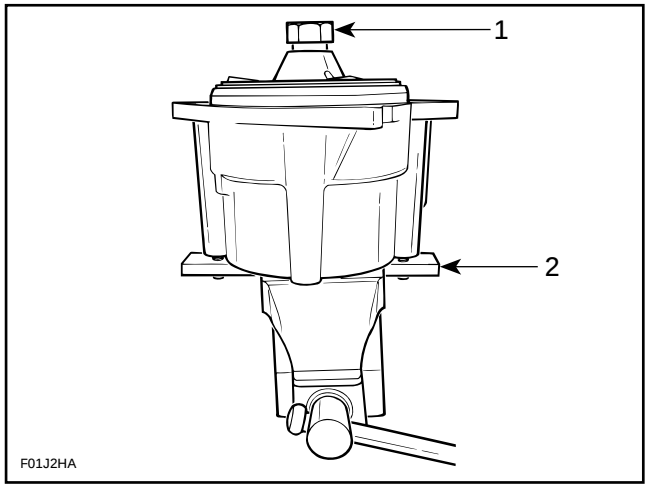
Using 2 screws previously removed from venturi, secure shaft holder to housing. Heat impeller center with a propane torch to approximately 150°C (300°F) to break the Loctite bond.

Impeller is loosened using impeller remover tool (P / N 295 000 001).

Install shaft holder in a vice.

Insert special tool in impeller splines.

Rotate impeller remover tool counterclockwise and unscrew completely impeller.



1. Impeller remover / installer tool
2. Impeller shaft holder tool

▼ CAUTION : Never use any impact wrench to loosen impeller.

To remove impeller, apply a rotating movement and pull at same time. Slide impeller out of housing and remove tool from impeller.

Remove 2 screws holding impeller housing to shaft holder.

Lift impeller housing away from impeller shaft.

Slide thrust washer and thrust bearing off from shaft.

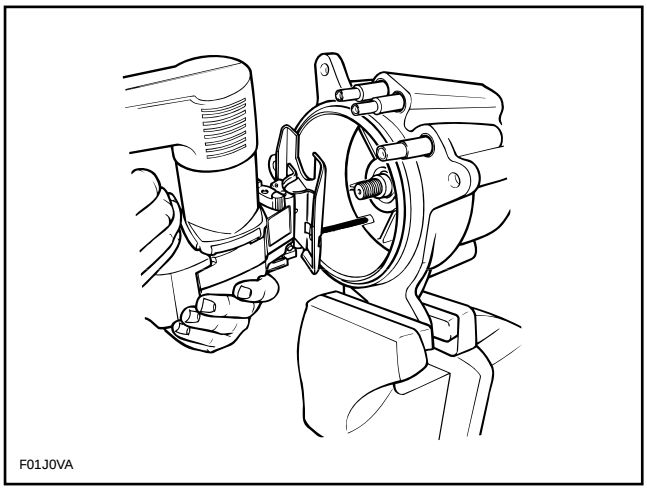
20, Wear Ring

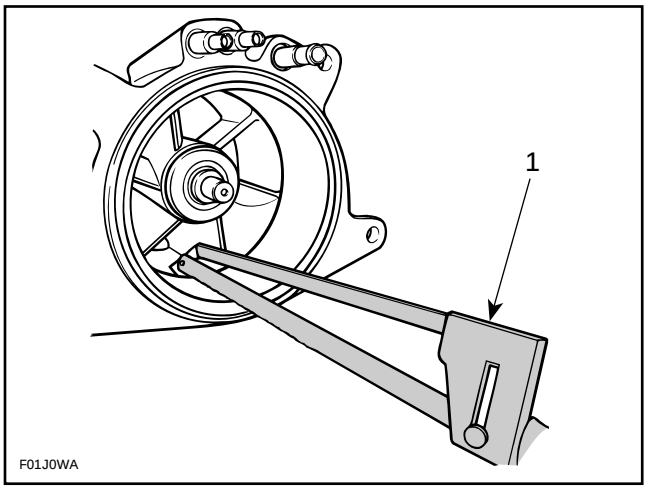
Place impeller housing in a vise with soft jaws. It is best to clamp housing using a lower ear.

Cut wear ring at two places.

○ NOTE : Wear ring can be cut using a jigsaw, a small grinder or a low clearance hacksaw such as Snap-on HS3 or equivalent.

▼ CAUTION : When cutting ring, be careful not to damage impeller housing.





1. Snap-on HS3

After cutting ring, insert a screwdriver blade between impeller housing and ring outside diameter.

Push ring so that it can collapse internally.

Pull ring out.

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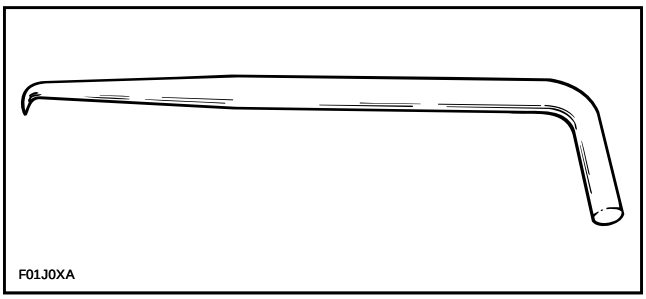
21, Seal

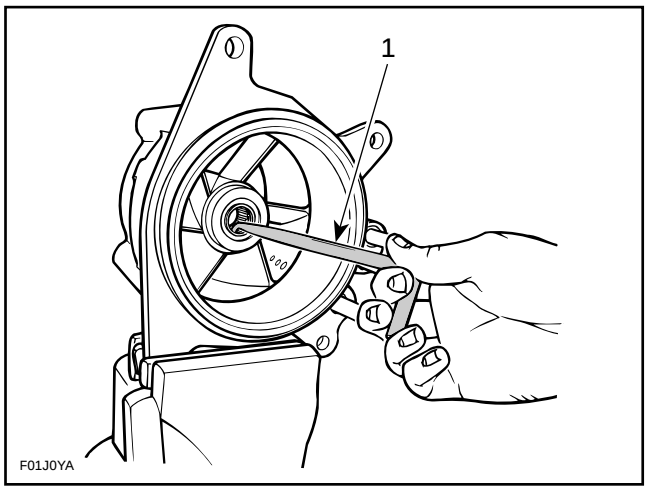
To remove seal, proceed as follows :

▼ CAUTION : It is not recommended to push seal out with a punch. Housing and / or bearing(s) could be damaged.

Seal should be removed using the following suggested tool.

Seal puller, Snap-on no. S6129.

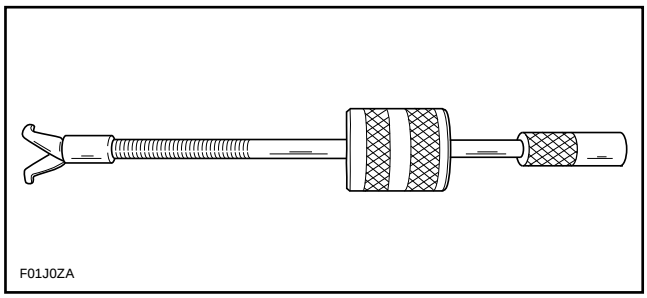




1. Pulling seal out of housing

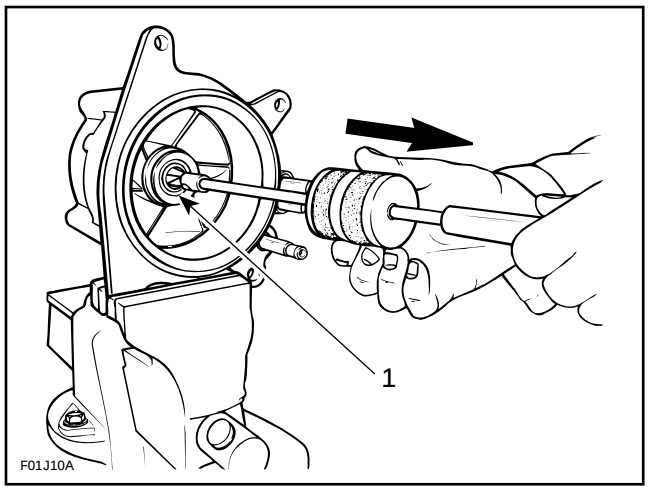
Or, use a Snap-on hammer puller including :

Handle	CJ93-1
Hammer	CJ125-6
Claws	CJ93-4



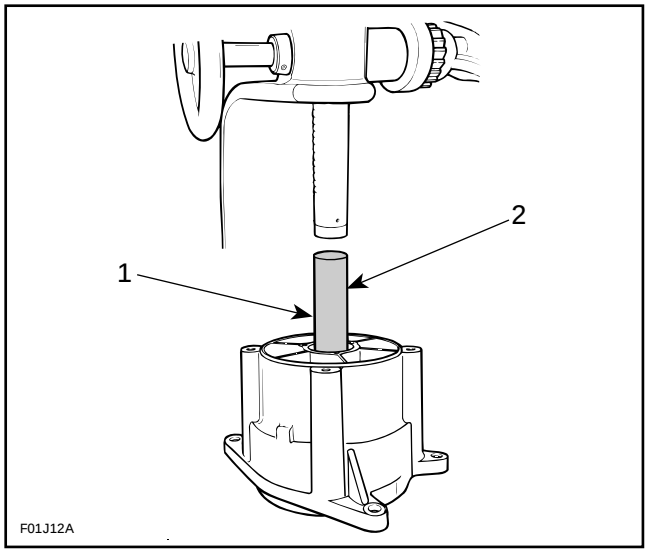
Close puller claws so that they can be inserted between seal and bearing. Holding claws, turn puller shaft clockwise so that claws open and tighten against seal.

Slide puller sleeve outwards and gently tap puller end. Work with small strikes otherwise claws will slip out. As soon as seal begins to slide out, retighten claws to maintain contact with seal. Continue pulling until seal is out.



1. Pulling seal out of housing

O NOTE : If bearings and seal need to be replaced the special driver described further on in bearing removal can be used. Simply insert driver from the rear and press parts towards the front.



1. Same tool for bearing removal
2. Removing seal and bearings out from rear

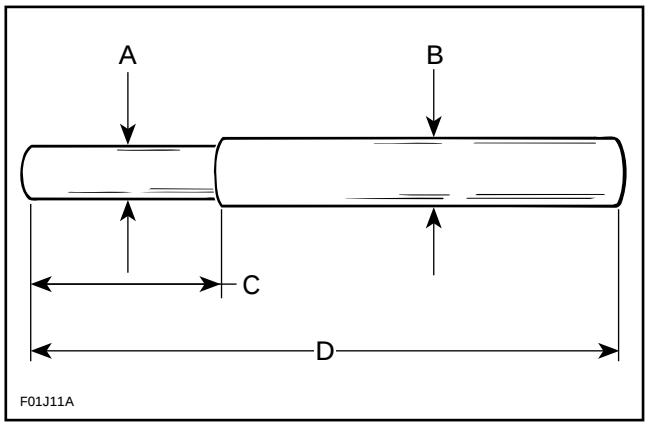
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22, Needle Bearing

NOTE : It is always recommended to renew both bearings, even if only one bearing needs to be replaced.

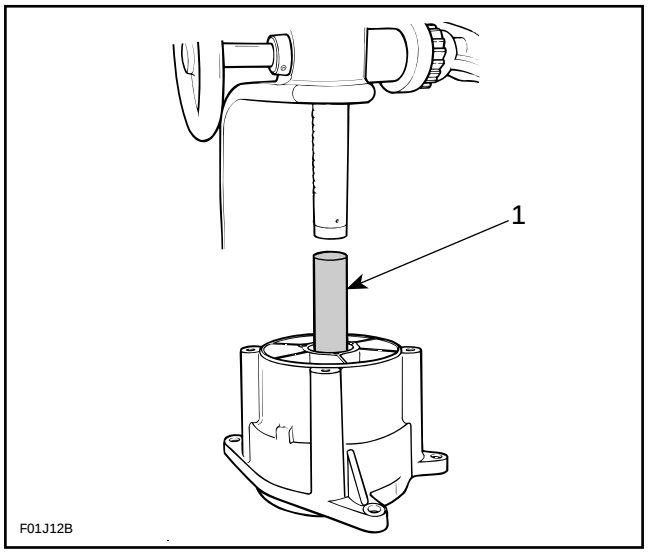
Bearings can be easily removed with the following suggested driver.

Use a 30 mm dia. x 345 mm (1-1/8 dia. x 13-1/2 in) long steel shaft. Machine shaft as per the following drawing.



A. 22 mm (.865 in) dia.
B. 28 mm (1.115 in) dia.
C. 90 mm (3-1/2 in)
D. 345 mm (13-1/2 in)

Insert driver into one bearing then press tool using a arbor press until bearings are out. However, care should be taken not to damage bearing journals.



1. Press bearings out

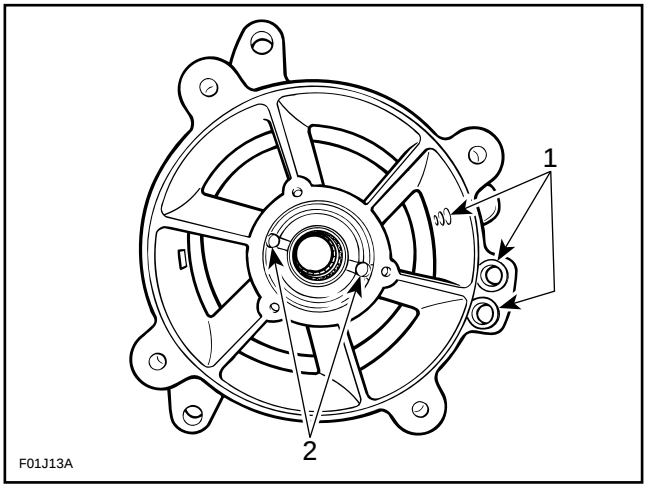
CLEANING

Sealant can be removed with a wire brush (disc) mounted on a drill or a scraper.

Properly clean all threads.

Remove all O-rings and clean parts in a solvent.

Carefully check water passages (bailer pick-up, cooling system) and oil passages. Blow low pressure compressed air through them and make sure they are clear.



1. Water passages
2. Oil passages

Brush and clean impeller shaft threads, impeller and drive shaft splines with Loctite Safety solvent 755

(P / N 293 800 019) or equivalent. Free threads and splines from any residue.

CAUTION : Be careful not to damage impeller shaft diameter.

PARTS INSPECTION

19, Impeller

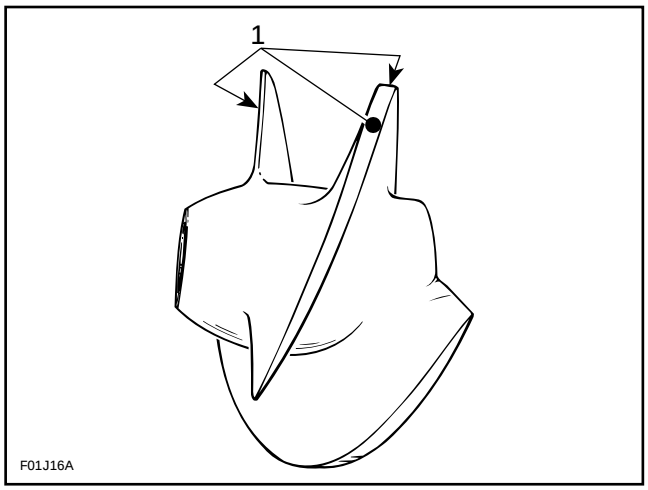
Visually inspect impeller splines. Check for wear or deformation. Renew parts if damaged.

NOTE : Check also flywheel and drive shaft condition. Refer to PROPULSION SYSTEM 09-02.

Examine impeller in wear ring for distortion.

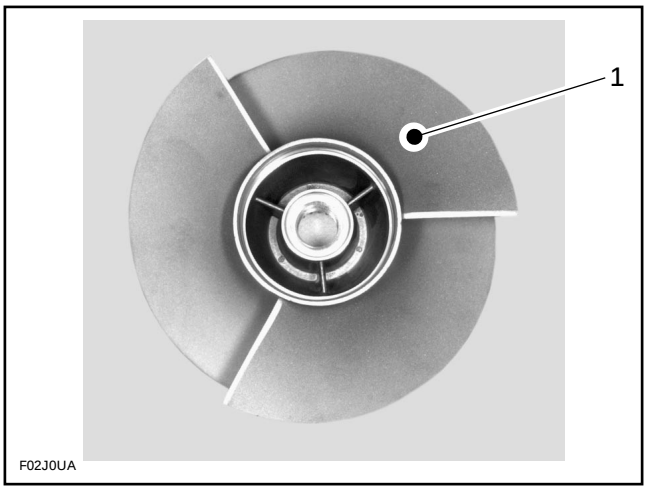
Check if blade tips are blunted round, chipped or broken. Such impeller is unbalanced and will vibrate and damage wear ring, impeller shaft, shaft seal or bearings. Renew if damaged.

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1. Replaced if blunted round or damaged

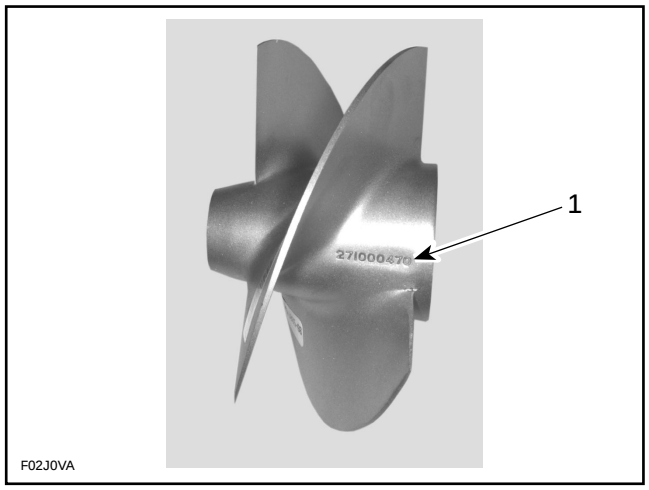
Check impeller for cavitation damage, deep scratches or any other damage.



1. Check for cavitation, deep scratches or other damage

Identification

To identify the impellers refer to the following illustration and chart.



1. Stamped part number

WATERCRAFT MODEL	IMPELLER P / N	MATERIAL	PITCH
SP	271 000 016	Aluminium	18.8°
SPX	271 000 497	Stainless steel	Progressive pitch 11°-24°
SPI	271 000 182	Stainless steel	Progressive pitch 11°-26°
XP	271 000 331	Stainless steel	Progressive pitch 17°-25°
HX	271 000 497	Stainless steel	Progressive pitch 11°-24°
GTS	271 000 416	Stainless steel	Progressive pitch 10°-25°
GTI	271 000 470	Stainless steel	Progressive pitch 11°-24°

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20, Wear Ring

Check wear ring for deep scratches, irregular surface or any apparent damage.

If impeller / wear ring clearance is too large and impeller is in good shape, renew wear ring.

22,23, Needle Bearing and Impeller Shaft

Wear

Inspect needle bearings and their contact surface. Check for scoring, pitting, chipping or other evidence of wear.

With your finger nail, feel contact surface of seal. If any irregular surface is found, renew impeller shaft.

Install bearings then install impeller shaft and rotate it. Make sure it turns smoothly.

Radial Play

Radial play is critical for jet pump unit life span.

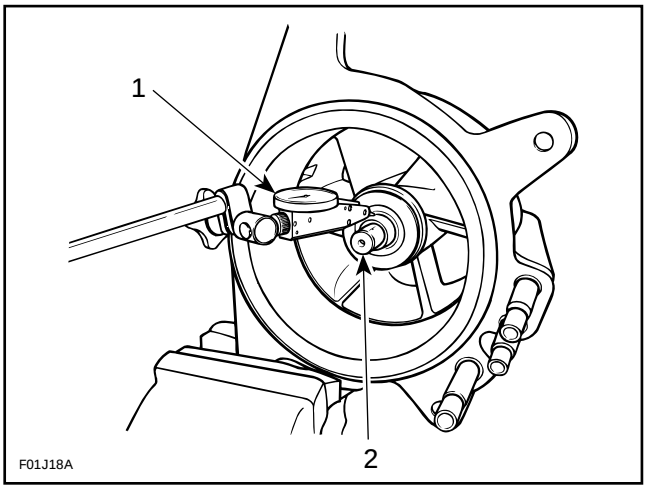
Radial play of impeller shaft is checked with shaft in housing, without impeller.

Retain housing in a soft jaw vise making sure not to damage housing lug.

Set a dial gauge and position its tip onto shaft end, close to end of threads.

Move shaft end up and down. Difference between highest and lowest dial gauge reading is radial play.

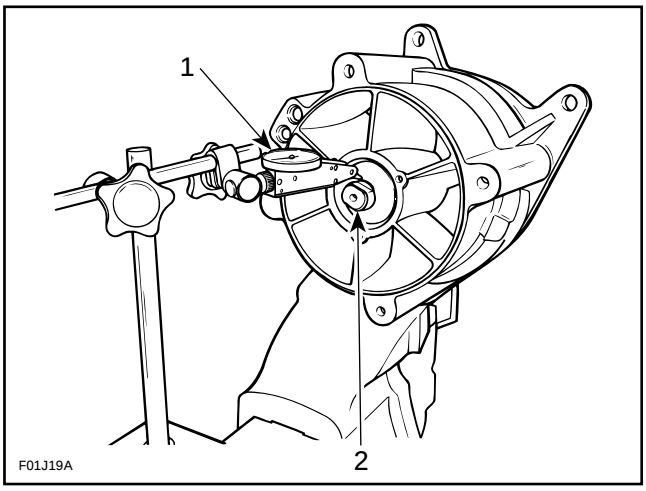
Maximum permissible radial play is 0.05 mm (.002 in).



MEASURING IMPELLER SHAFT RADIAL PLAY

1. *Dial gauge*
2. *Measure close to threads at shaft end*

To check both bearings, proceed the same way with other shaft end. Position gauge tip on diameter, close to flats on shaft.



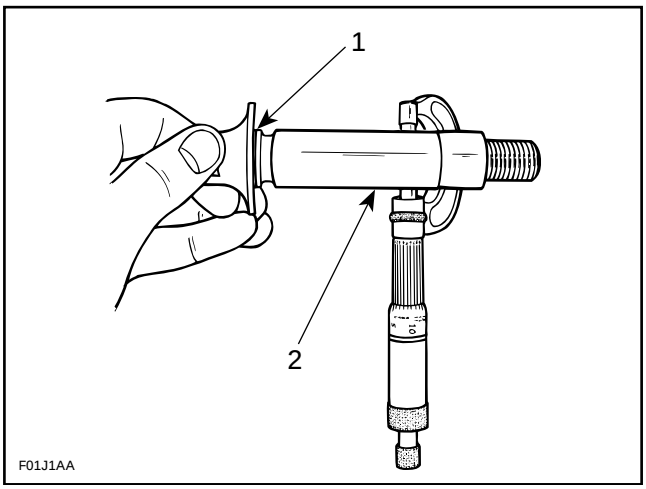
MEASURING IMPELLER SHAFT RADIAL PLAY

1. *Dial gauge*
2. *Measure close to flats at shaft end*

Excessive play can come either from worn bearings or impeller shaft or damaged impeller housing bearing surfaces.

Measuring shaft diameter will determine the defective parts.

Using a micrometer, measure diameter on bearing contact surfaces. Minimum shaft diameter should be 22.24 mm (.876 in).



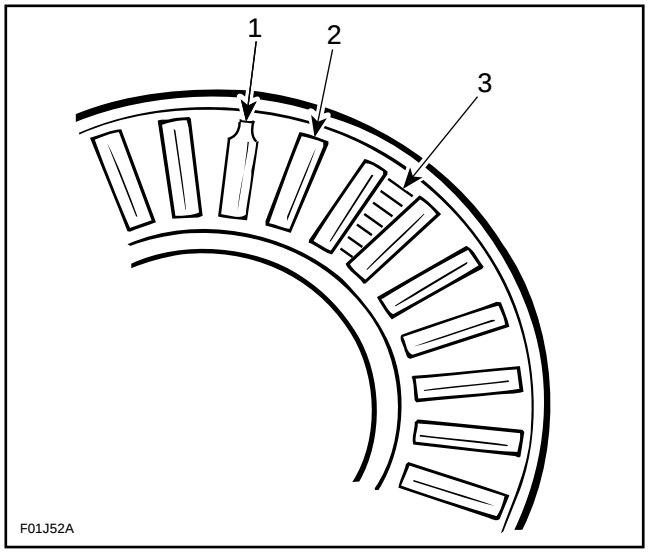
1. *Inspect for wear at the bearing pilot*
2. *Radial bearing raceway*

NOTE : If shaft is to be replaced, it is recommended to replace both bearings at the same time. In addition, it is suggested to replace thrust bearing and thrust washer.

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24,25, Thrust Washer and Thrust Bearing

Visually inspect thrust washer, thrust bearing and their contact surface. Check for scoring, pitting, flaking, discoloration or other evidence of wear. For best inspection, use a 7X magnifying glass to check wear pattern.



TYPICAL

1. *Worn roller (trunnion worn on end roller)*
2. *Good roller (cylindrical shape)*
3. *Look for scoring on retainer*

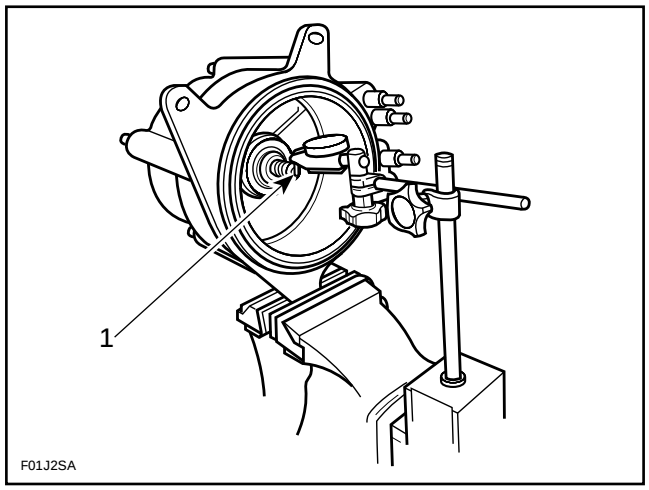
NOTE : When replacing either washer or bearing, it is recommended to renew both.

17,23, Housing Cover and Impeller Shaft

End Play

End play of impeller shaft is checked with shaft in housing, without impeller and with housing cover installed.

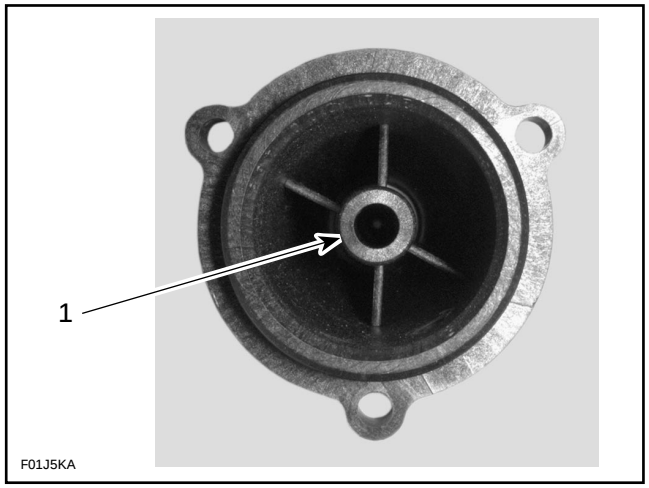
Retain housing in a soft jaw vise making sure not to damage housing lug. Set a dial gauge and position its tip on the end of shaft. Move shaft end by pulling and pushing. Difference between highest and lowest dial gauge reading is end play. Maximum permissible end play (new) is 0.12 - 0.54 mm (.005 - .021 in). Make sure vise is secured and not adding to your measurement as you move impeller shaft.



1. Tip on shaft end

Excessive play comes from worn end stop inside housing cover and wear of impeller shaft nose.

Visually inspect end stop inside cover. If worn, a small peak in center will be apparent.



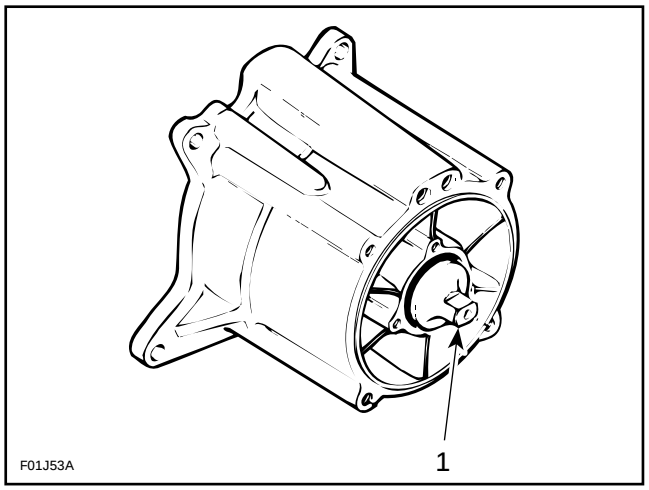
TYPICAL

1. End stop

If impeller shaft end play is excessive, housing cover should be replaced. Be sure to check end play after installing a new housing cover.

Inspect impeller shaft nose for wear.

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1. Impeller shaft nose

21, Seal

Carefully inspect seal lips. Make sure that lips are not worn, distorted, cracked or show signs of any other damage. Renew as necessary.

JET PUMP ASSEMBLY

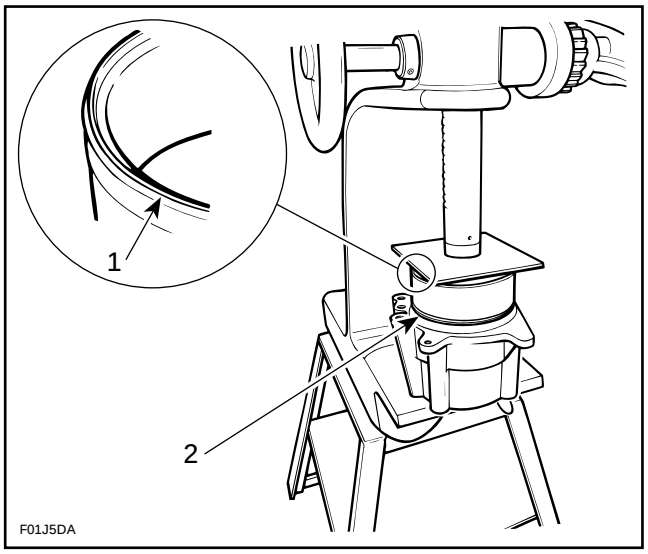
20, Wear Ring

The wear ring features a lip on one edge ; position lip outwards of housing.

NOTE : To ease insertion into housing, apply BOMBARDIER LUBE lubricant (P / N 293 600 016) onto outside circumference of wear ring.

To install ring in housing, use a square steel plate approx. 180 x 180 mm x 6 mm thick (7 x 7 in x 1/4 in) and a press.

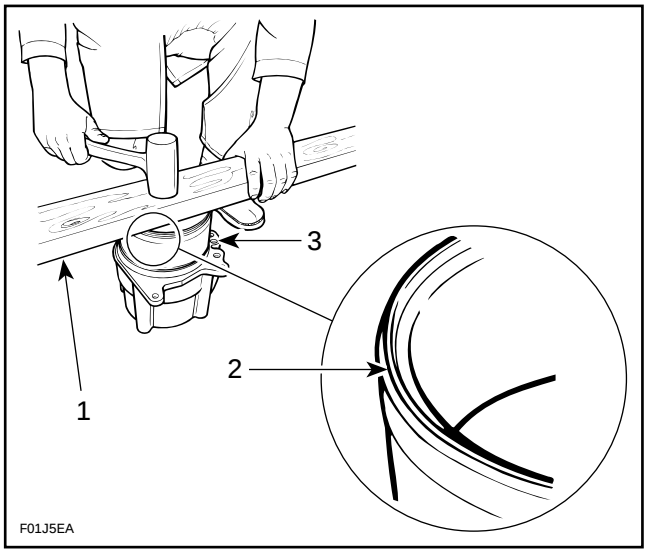
Manually engage ring in housing making sure it is equally inserted all around. Press ring until it seats into bottom of housing.



1. Seal lip
2. Press wear ring

If a press is not readily available, a piece of wood such as a 2 x 4 x 12 in long, can be used.

Manually engage ring in housing making sure it is equally inserted all around. Place wood piece over ring. Using a hammer, strike on wood to push ring. Strike one side then rotate wood piece about 90° and strike again. Frequently rotate wood piece so that ring slides in evenly until it seats into bottom of housing.

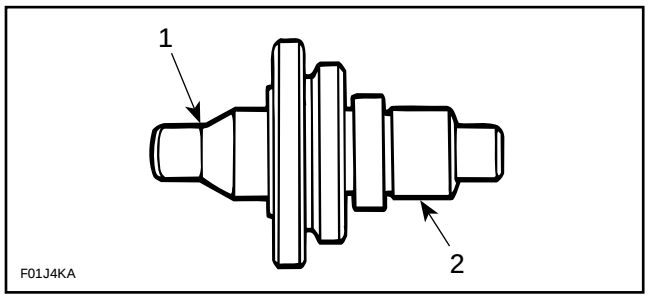


1. Piece of wood
2. Seal lip facing upward
3. Wear ring

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21,22, Seal and Needle Bearing

Bearings and seal will be properly installed in housing using bearing / seal installer tool (P / N 295 000 107).

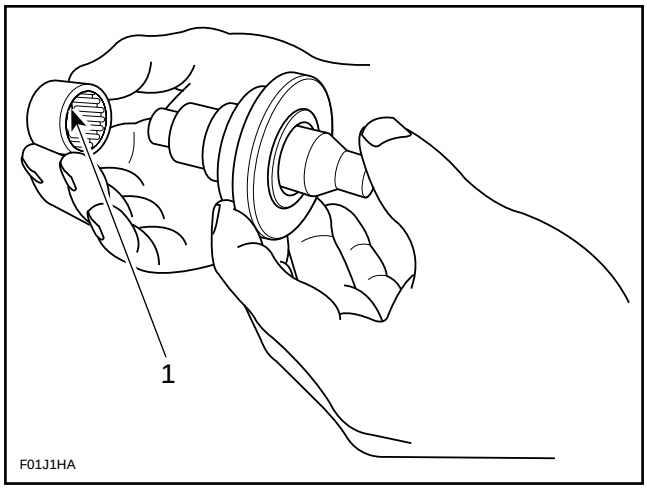


BEARING / SEAL INSTALLER TOOL

1. *Seal side*
2. *Bearing side*

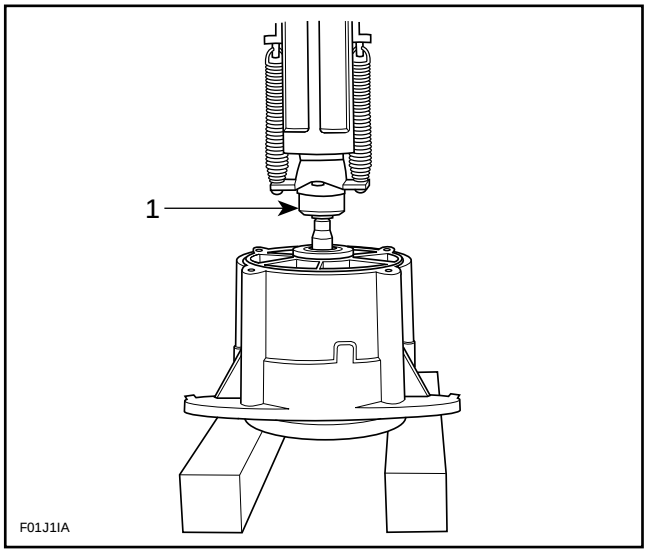
Stamped end of bearings (showing identification markings) must be located toward outside of housing.

Properly insert bearing on tool. Using an arbor press only, push tool until tool flange contacts housing. Proceed the same way for both bearings.



1. *Stamped end this side*

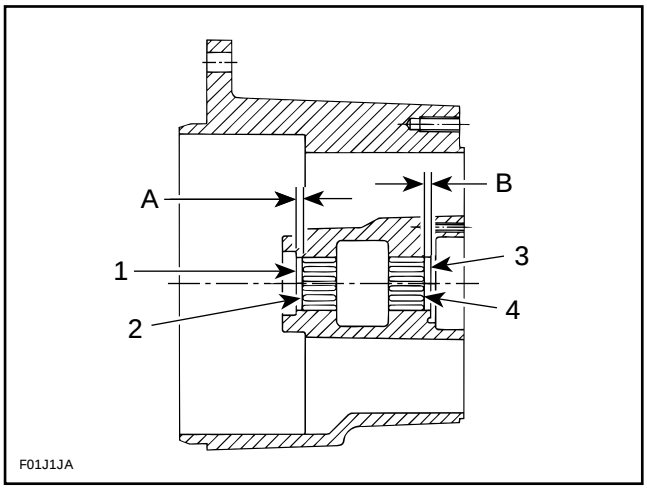
▼ CAUTION : Never hammer the bearing into its housing.



1. *Press on tool until it stops*

▼ CAUTION : This tool have been designed to properly position bearings and seal, thus providing space for lubrication purposes. The tool flanges allow this. If a different pusher type is being used, components must be properly positioned as follows.

Bearing on impeller side must be 1.5 to 2.5 mm (.060 - .100 in) inside reservoir measured from seal seat. Bearing on venturi side must be 2 to 3 mm (.080 - .120 in) inside reservoir measured from thrust washer seat. Refer to following illustration.



1. *Seal seat*
2. *Stamped end of bearing*
3. *Thrust washer seat*
4. *Stamped end of bearing*

A. 1.5 - 2.5 mm (.060 - .100 in)
B. 2 - 3 mm (.080 - .120 in)

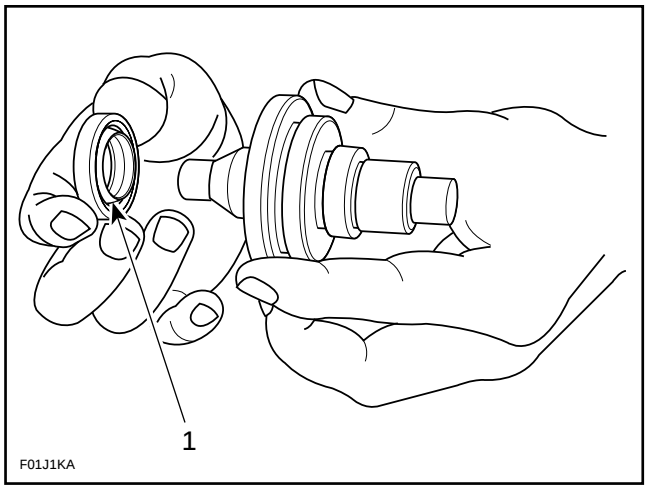
Seal must be installed so that lips raised edges are toward outside of housing (toward impeller).

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Apply Loctite 518 (P / N 293 800 038) to seal housing, all around outer diameter and on seal seat.

Properly insert seal on tool.

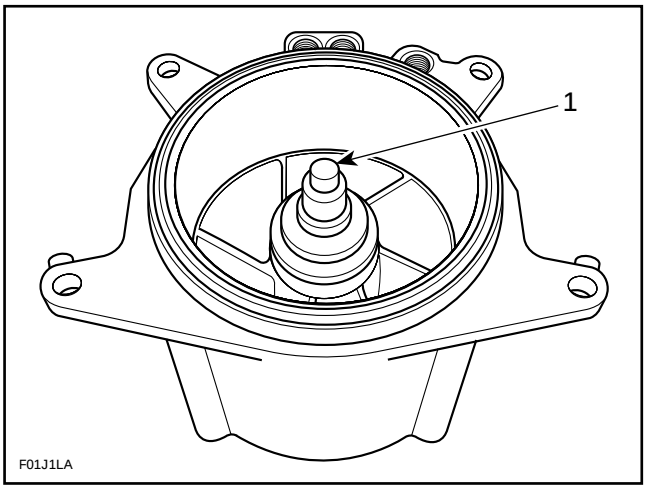
NOTE : It is important when installing seals to pack seal lip with grease before inserting bearing / seal installer tool. Properly insert tool in seal with a rotating movement.



1. Raised edge of seal this side

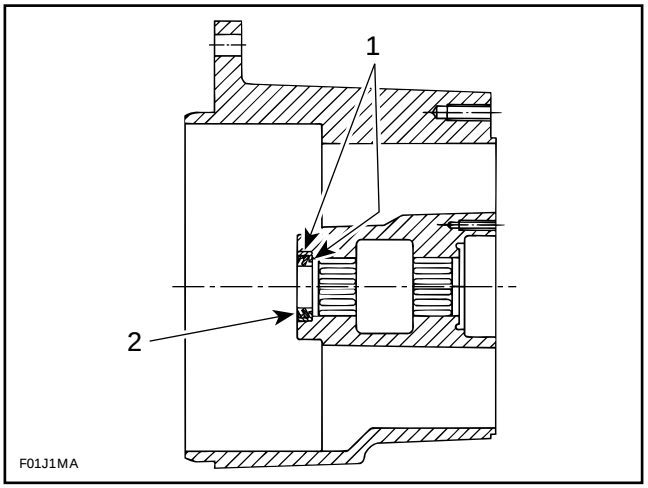
CAUTION : Prevent sealant from contacting any needles of bearing.

Push on tool end with a press until tool flange contacts housing.



1. Press on tool until it stops

Apply synthetic grease (P / N 293 550 010) between seal lips.



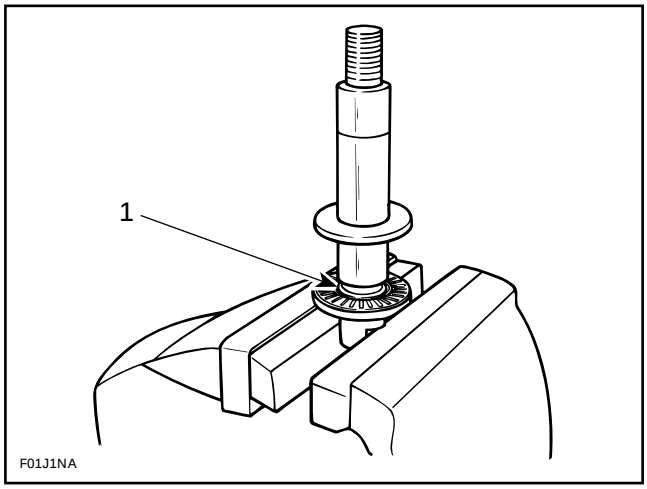
1. Loctite 518 all around and behind
2. Raised edge of seal lip this side

7,19,23,24,25, Impeller Housing, Impeller, Impeller Shaft, Thrust Washer and Thrust Bearing

Insert impeller shaft flats in a vise so that shaft is vertical.

Apply Sea-Doo jet pump synthetic oil (P / N 293 600 011) on both sides of thrust bearing then insert onto shaft followed by thrust washer. Make sure bearing is leaning against shaft flange and washer is properly centered. Oil will prevent parts from sliding at installation and thus possibly wedging thrust bearing into shaft groove.

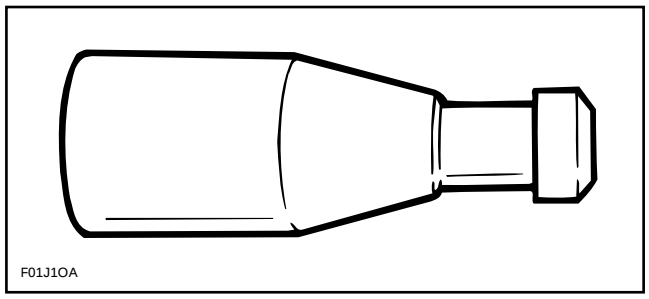
CAUTION : It is critical to keep thrust bearing and washer properly centered on shaft during assembly of pump.



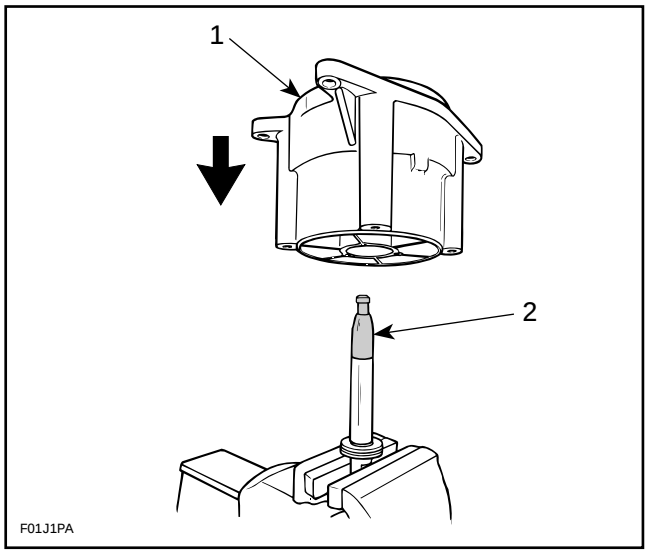
1. Apply oil on faces of parts to prevent them to slide and wedge into shaft groove

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To prevent seal lip damage when inserting impeller shaft, use impeller shaft guide (P / N 295 000 002).



Insert tool onto shaft end then carefully slide housing over shaft.



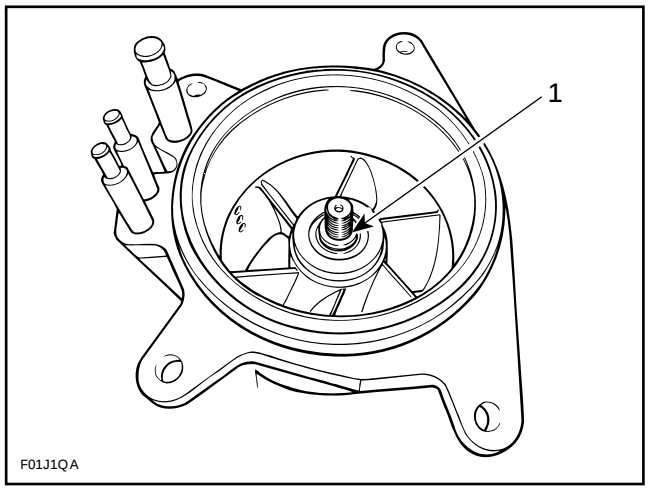
1. Carefully insert housing onto shaft
2. Impeller shaft guide tool

Remove special tool.

Apply Loctite primer N (P / N 293 600 012) on impeller shaft threads. Allow to dry for 2 minutes.

NOTE : Loctite primer is used to reduce Loctite 271 curing time and to activate stainless steel and aluminum surfaces for better bonding action. If applied, complete curing time is 6 hours, if primer is not used, allow 24 hours for curing time.

Apply Loctite 271 (red) to shaft threads.



1. Apply Loctite 271 (red) on threads

Using 2 screws previously removed from venturi, secure impeller shaft holder tool to housing. Install shaft holder tool in a vice.

To ease impeller installation, apply BOMBARDIER LUBE lubricant on wear ring.

Insert impeller into wear ring. Manually rotate impeller and push so that it slides on impeller shaft threads. Carefully engage threads making sure they are well aligned.

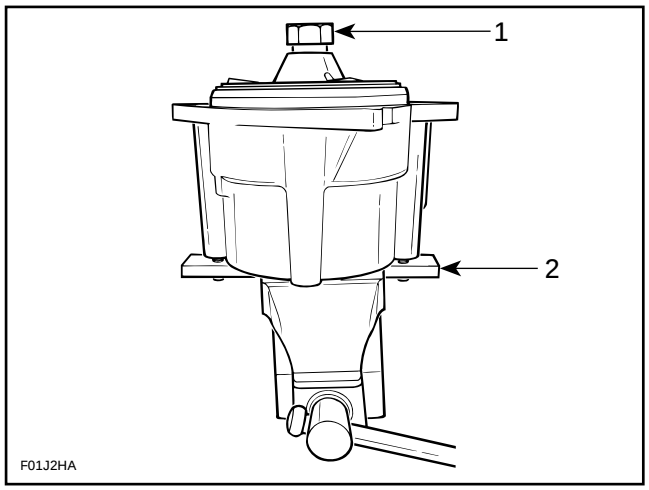
Install impeller remover / installer tool into impeller splines and tighten.

CAUTION : Make sure thrust washer and bearing are not wedged in shaft groove. To check, manually pull and push impeller housing, some axial play must be felt (maximum 0.54 mm (.021 in)).

Torque impeller to 70 N•m (52 lbf•ft) then remove tools.

CAUTION : Never use any impact wrench to tighten impeller.

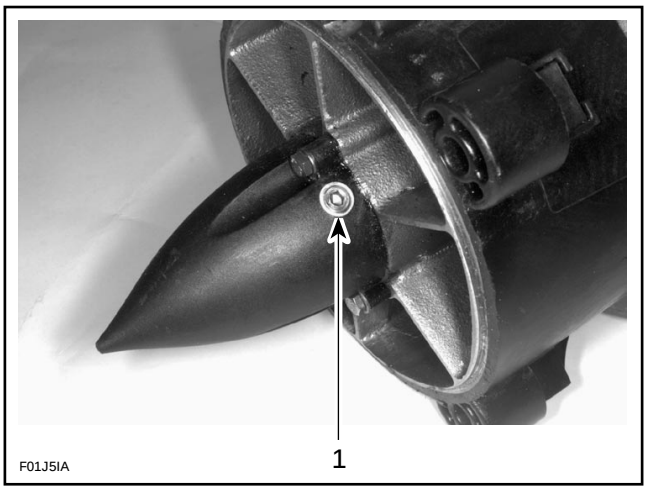
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1. Impeller remover / installer tool
2. Impeller shaft holder tool

17,26, Housing Cover and O-ring

Install O-ring to cover. Apply Loctite 518 on O-ring. Install cover to impeller housing making sure to properly position filler plug on top side.



1. Filler plug toward top side of pump housing

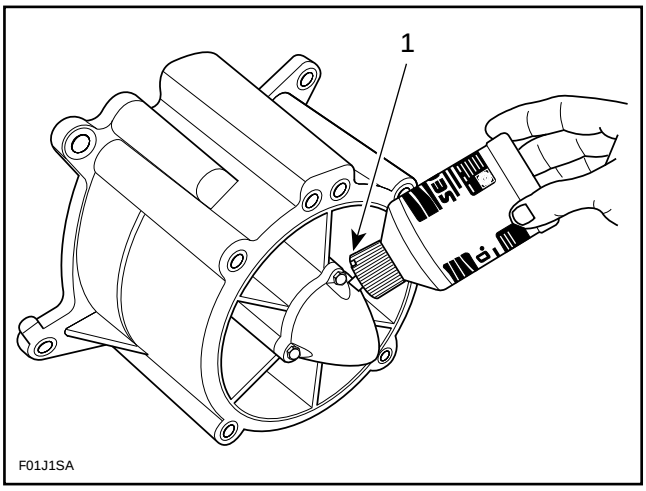
Apply Loctite 242 (blue) on screw threads and evenly tighten cover screws. Torque to 4 N•m (35 lbf•in).

Oil Fill

Place housing horizontally as in its operating position so that filler plug is located on top. Remove filler plug from cover. Pour SEA-DOO JET PUMP SYNTHETIC OIL (P / N 293 600 011) in reservoir until oil comes level with bottom of hole. Let oil drain into housing and after a few minutes add more oil until it is level with bottom of filler hole. Oil capacity is 90 mL (3 oz).

▼ CAUTION : This is a synthetic oil. Do not mix with mineral based oil. Do not mix oil brands.

○ NOTE : When filling reservoir, oil must be poured into cover quite slowly to allow complete housing fill.



1. Pour oil slowly until it is level with bottom of filler hole

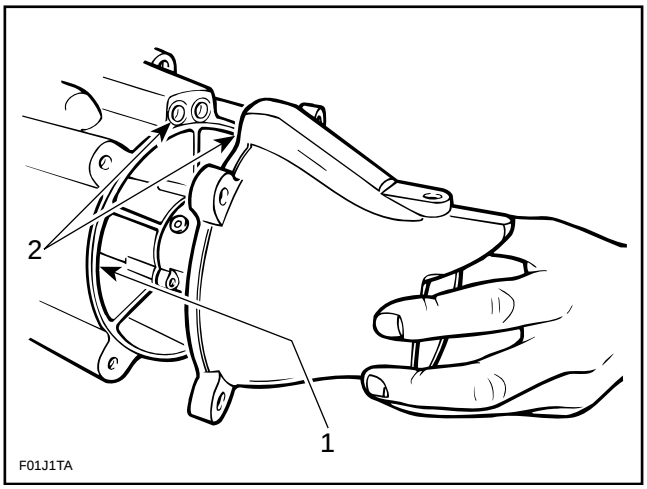
At this stage, a pressure test should be performed to detect any leakage of the jet pump. Refer to PUMP PRESSURIZATION in this sub-section.

8,9,10, O-ring, Venturi and Screw

If needed, install new O-rings around bailer passages.

Apply Loctite 518 (Gasket Eliminator) on mating surface.

Position venturi with bailer passages on top.



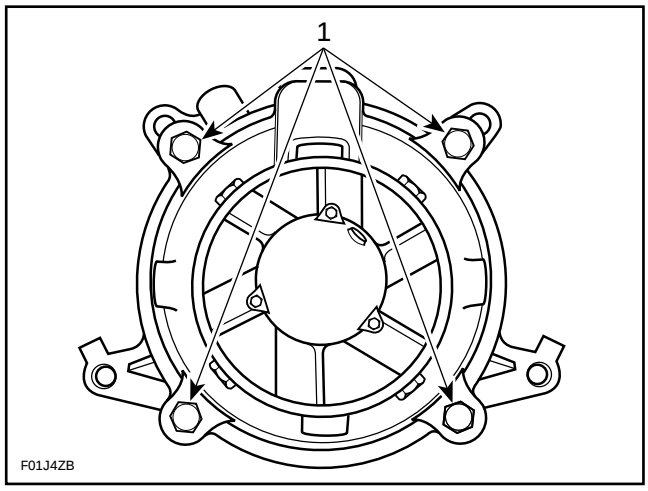
1. Loctite 518 on mating surface
2. Bailer passages aligned

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Aluminum Impeller Housing

Apply Loctite 242 (blue) on screw threads.

Install screws and washers then torque to 25 N•m (18 lbf•ft) in a criss-cross sequence.

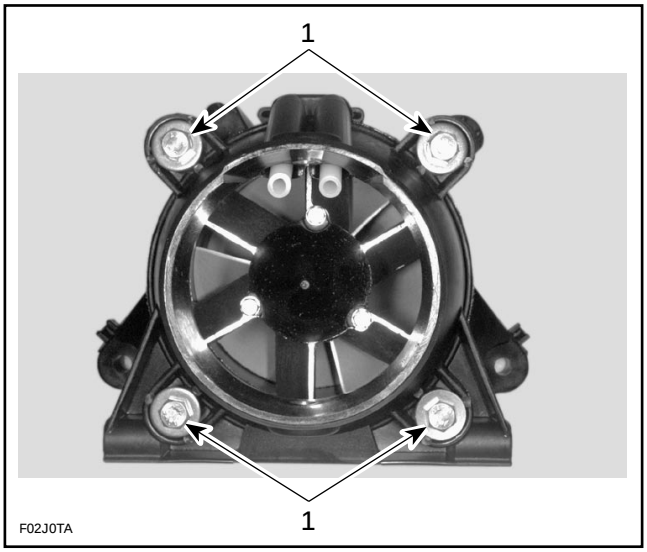


1. Torque screws to 25 N•m (18 lbf•ft)

Plastic Impeller Housing

Apply Loctite 242 (blue) on screw threads.

Install screws and washers then torque to 21 N•m (16 lbf•ft).



1. Torque screws to 21 N•m (16 lbf•ft)

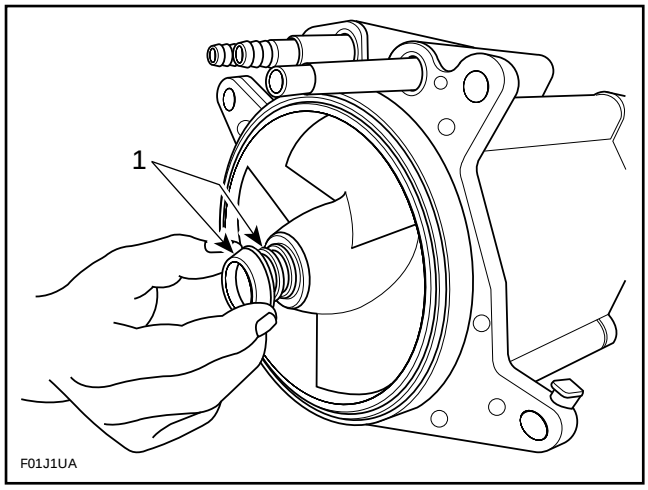
16, Fitting

Apply Loctite PST 592 on plastic fitting threads. Then thread fitting into pump housing until threads are bottomed.

14,15,19, Boot, Ring and Impeller

Apply synthetic grease (P / N 293 550 010) on impeller splines.

Insert a new boot and ring to impeller.



1. Insert boot and ring

PUMP PRESSURIZATION

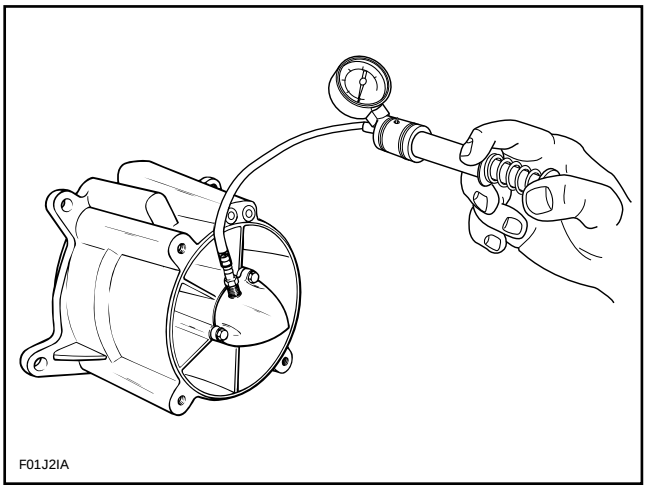
Whenever doing any type of repair on jet pump, a pressure test should be done to check for leakage.

NOTE : After complete rebuilding of the jet pump, oil MUST be added to the housing BEFORE performing the pressure test in order to seat the new seal, otherwise it will leak.

Proceed as follows :

– Remove drain plug from housing cover.
– Apply Loctite PST 592 on threads of fitting tool (P / N 295 000 086) then secure on cover.
– Connect pump gauge tester (P / N 295 000 083) to fitting.
– Pressurize pump to a maximum of 70 kPa (10 PSI).

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– Pump must maintain this pressure for at least 10 minutes.

▼ CAUTION : Repair any leak, failure to correct a leak will lead to premature wear of pump components.

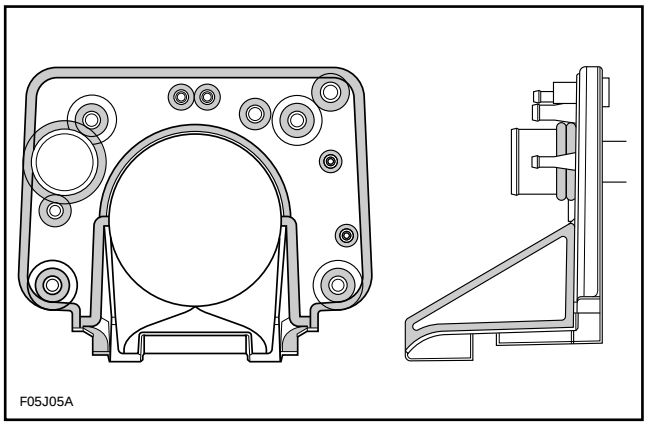
O –NOTE : If there is a pressure drop spray soapy water around housing cover. If there are no bubbles, impeller shaft, impeller shaft seal, or impeller housing is leaking through porosity and has to be replaced. Jet pump unit has to be disassembled.

– Disconnect pump gauge tester and remove fitting.
– Check oil level. Refill as necessary.
– Apply Loctite PST 592 to threads of filler plug then secure it in cover.

JET PUMP SUPPORT INSTALLATION

HX Model Only

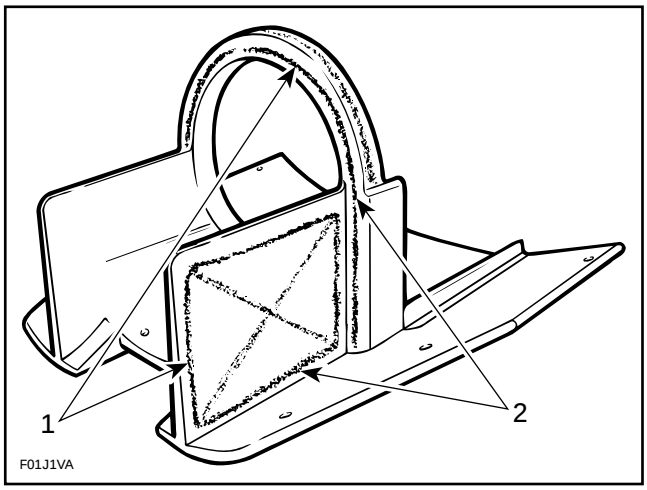
Apply Loctite 598 Ultra Black on support as shown in the following illustration.



Installation of support is essentially the reverse of removal procedure.

RIDE SHOE INSTALLATION

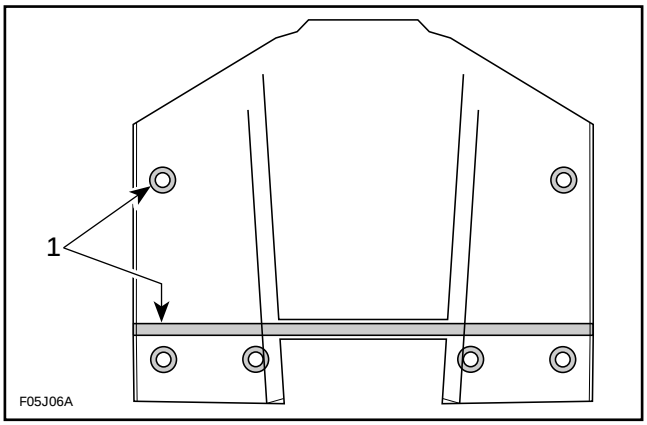
Apply Loctite 598 Ultra Black on ride shoe as shown in the following illustrations.



ALL MODELS EXCEPT HX

1. Apply Loctite 598 Ultra Black as indicated by shaded area

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HX MODEL

1. Apply Loctite 598 Ultra Black as indicated by shaded area

Carefully install ride shoe on hull. Apply Loctite 242 (blue) on screw threads, install and tighten in a criss-cross sequence. Torque to 10 N•m (88 lbf•in).

From inside of bilge, apply 732 sealant (P / N 293 800 006 or P / N 293 800 003) on end of screws to completely seal hull.

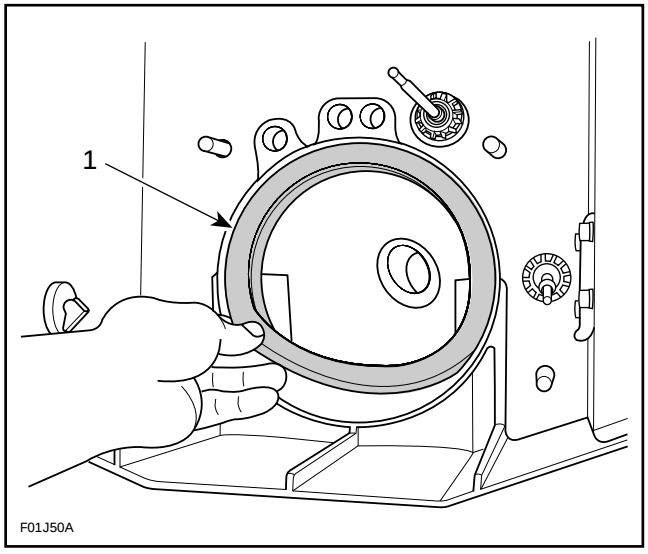
Apply Loctite 242 (blue) on intake grate screw threads, install and tighten. Torque screws to 8 N•m (71 lbf•in).

JET PUMP INSTALLATION

All Models Except HX

28, Neoprene Seal

If neoprene seal is damaged, replace it with a new one.



TYPICAL

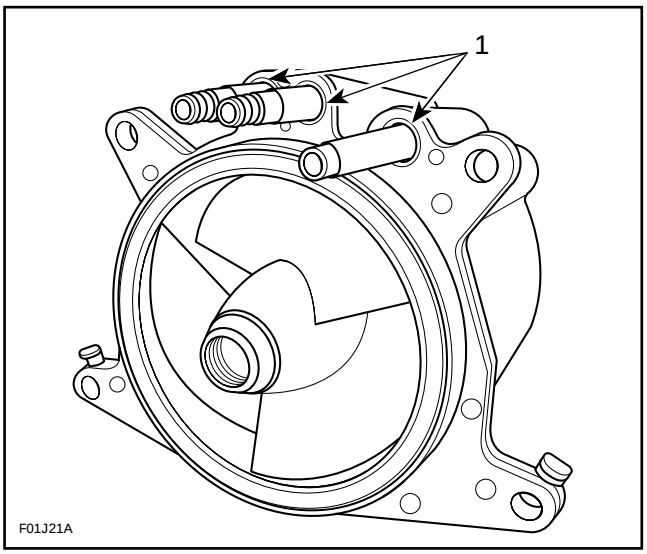
1. Neoprene seal

Miscellaneous

Generously apply synthetic grease on drive shaft splines.

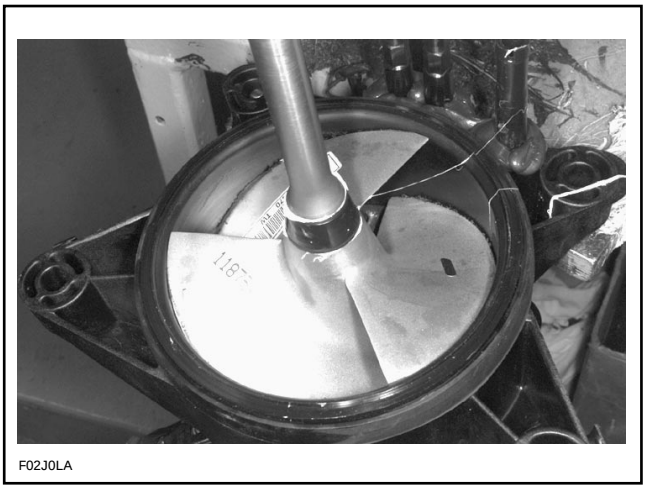
Make sure rubber damper is on drive shaft ends.

Apply Loctite 598 Ultra Black around bailer and water inlet supply fittings.



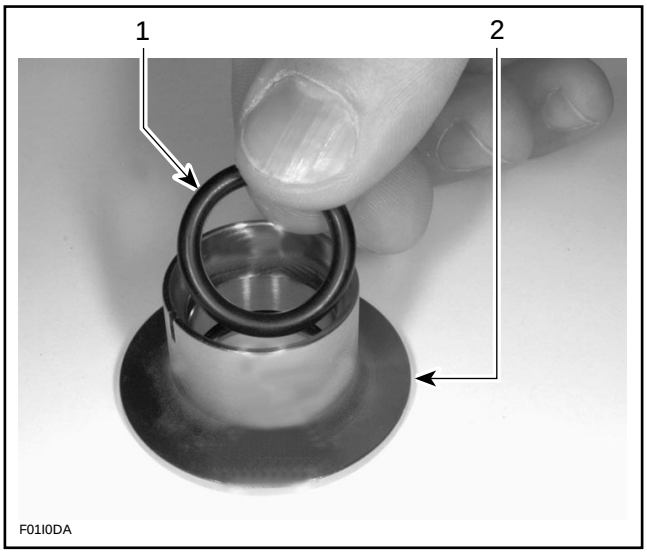
1. Apply Loctite 598 Ultra Black where indicated

Install drive shaft in impeller.



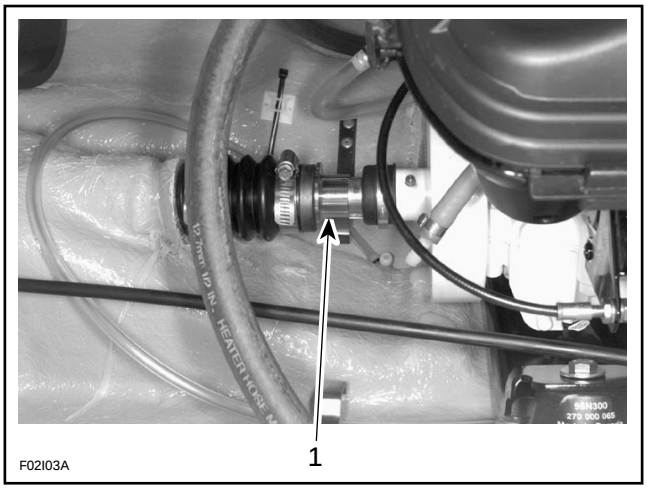
Position the O-ring of the drive shaft in the floating ring flange.

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1. O-ring
2. Floating ring

Position the floating ring between the carbon ring and the PTO flywheel boot.



1. Floating ring

Install jet pump with drive shaft.

▼CAUTION : Some watercraft require a shim between hull and pump ; if shim has been removed at pump removal, be sure to re-install it, otherwise engine alignment will be altered.

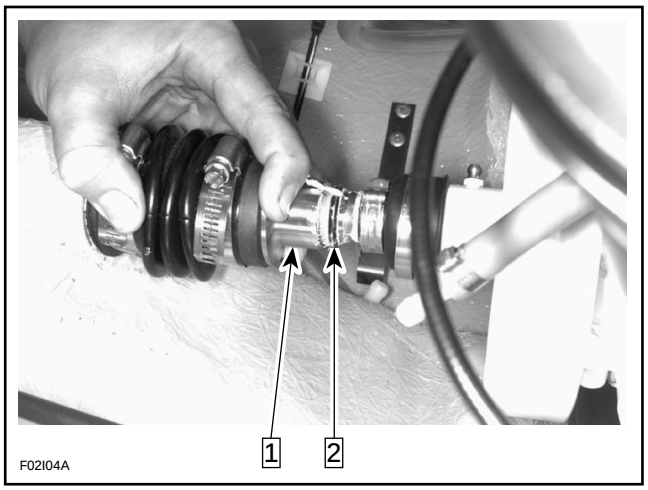
▼CAUTION : Take care not to break the O-ring in the floating ring flange while inserting the drive shaft.

Engage drive shaft splines in PTO flywheel. Rotate shaft to properly index splines. Make sure boot is well positioned over shaft end.

Apply Loctite 242 (blue) on stud threads of jet pump housing.

Install flat washers, lock washers and nuts. Tighten nuts of impeller housing in a criss-cross sequence and torque to 35 N•m (26 lbf•ft).

Push the floating ring to compress the protective hose. Insert the O-ring in the drive shaft groove.

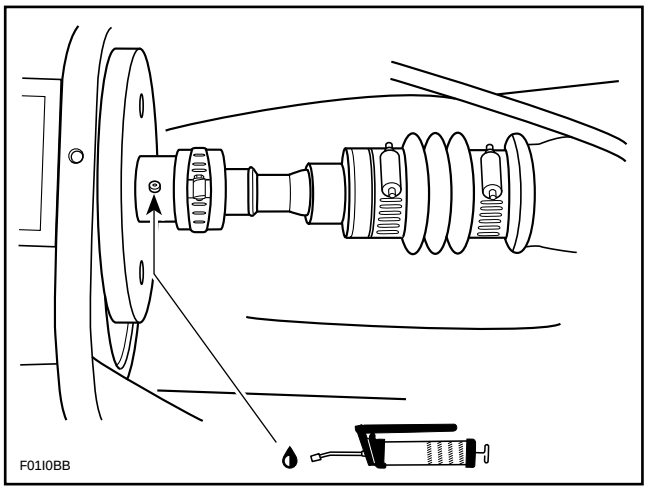


Step 1 Push floating ring
Step 2 Insert O-ring in the groove

Slide the floating ring onto the O-ring.

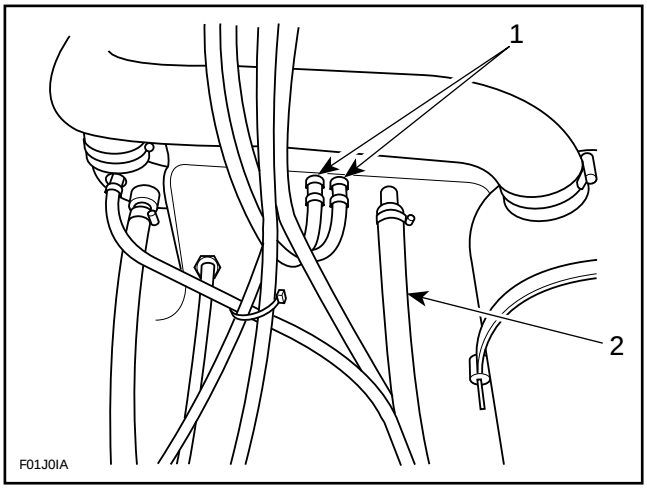
Secure small clamp of PTO flywheel boot. Refer to PROPULSION SYSTEM 09-02.

Using a grease gun, carefully lubricate PTO flywheel with synthetic grease (P / N 293 550 010), until boot is just beginning to expand. At this point, immediately stop greasing.



Secure water inlet hose and both bailer tubes to impeller housing using tie raps.

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1. Bailer tubes
2. Water inlet hose

Secure flywheel guard to engine studs using 1 nut and 1 washer on each side of guard.

Reinstall air vent tube support onto body (SP / XP series).

HX Model Only

Make sure rear drive shaft is properly installed.

Install jet pump. If necessary, wiggle jet pump to engage drive shaft splines in impeller.

Install flat washers, lock washers and nuts. Tighten nuts of impeller housing in a criss-cross sequence and torque to 31 N•m (23 lbf•ft).

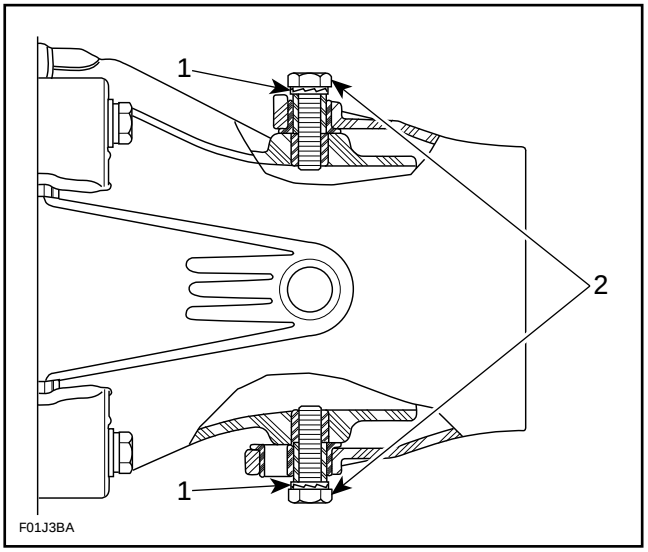
SP, GTS and GTI Models

1,2,3,4,5, Screw, Sleeve, Bushing, Locking Disk and Nozzle

Insert bushings in nozzle, positioning their flanges from inside of nozzle.

Insert sleeves in bushings.

Install nozzle on venturi ; position its steering arm on RH side. Apply Loctite 242 (blue) on screw threads (or use new screws with pre-applied Loctite). Install screws and locking disks then torque to 20 N•m (15 lbf•ft).



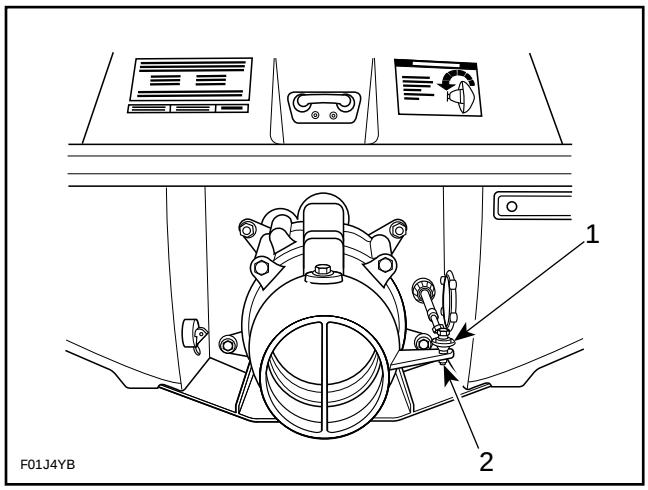
TYPICAL

1. Locking disks
2. Torque to 20 N•m (15 lbf•ft)

◆ WARNING : Whenever removing screw always renew locking disks. Screw must be torqued as specified.

Steering and Reverse Cables

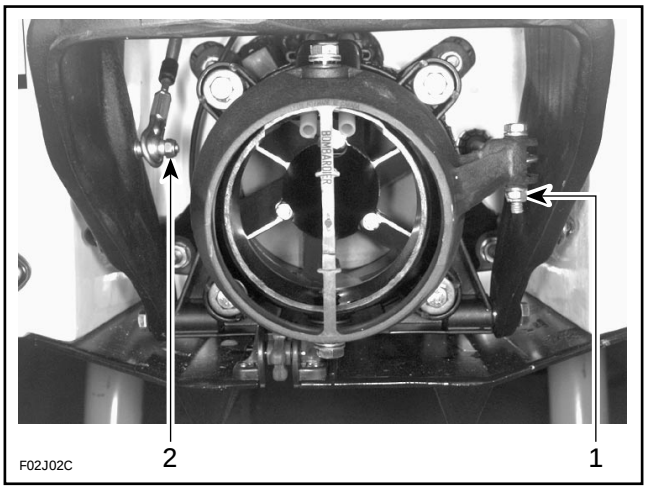
Secure ball joints of steering cable and reverse cable (GTS and GTI models).



TYPICAL - ALUMINUM NOZZLE

1. Ball joint on top of arm
2. Torque nut to 7 N•m (62 lbf•in)

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TYPICAL - PLASTIC NOZZLE

1. *Torque nut of steering cable ball joint to 7 N•m (62 lbf•in)*
2. *Torque nut of reverse cable ball joint to 7 N•m (62 lbf•in) (if applicable)*

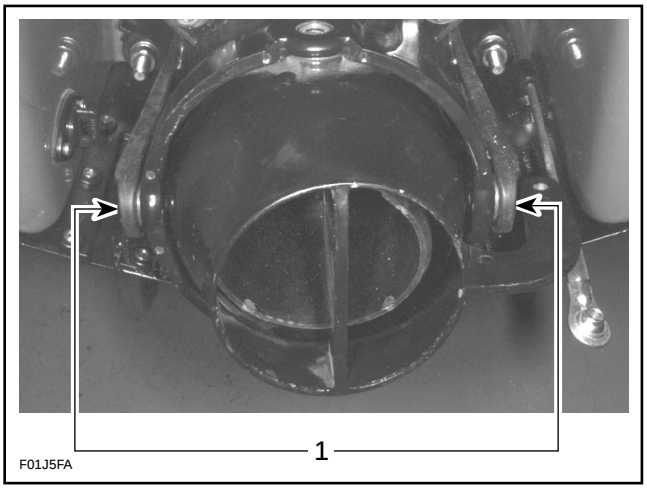
HX, SPI, SPX and XP Models

5, Nozzle

Install nozzle / trim ring assembly.

Torque screws to 14 N•m (10 lbf•ft).

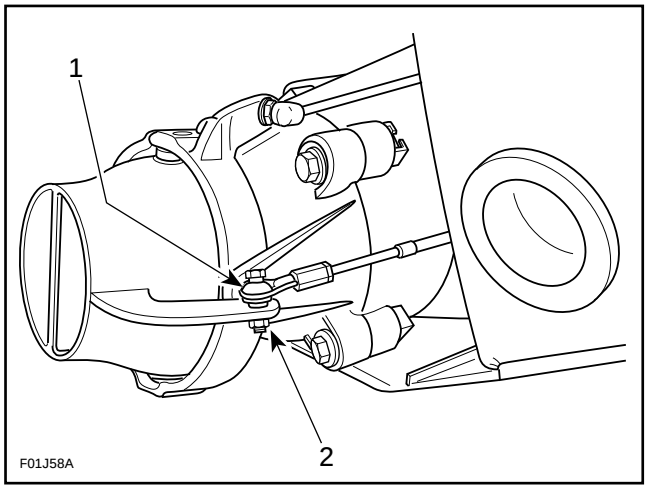
NOTE : Trim ring has a tight fit ; to install, insert both sides at the same time, taking care not to break plastic bushings. Carefully use a plastic tip hammer if necessary. Make sure steering arm of jet pump is on right side and trim arm is above venturi housing.



1. *Torque screws to 14 N•m (10 lbf•ft)*

Steering Cable

Secure ball joint of steering cable.



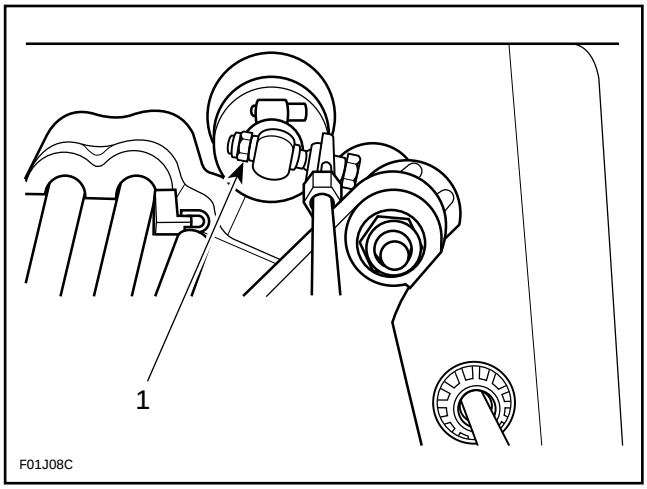
TYPICAL

1. *Ball joint on top of arm*
2. *Torque nut to 7 N•m (62 lbf•in)*

Trim Systems

SPX and XP Models

Secure ball joint of VTS link rod

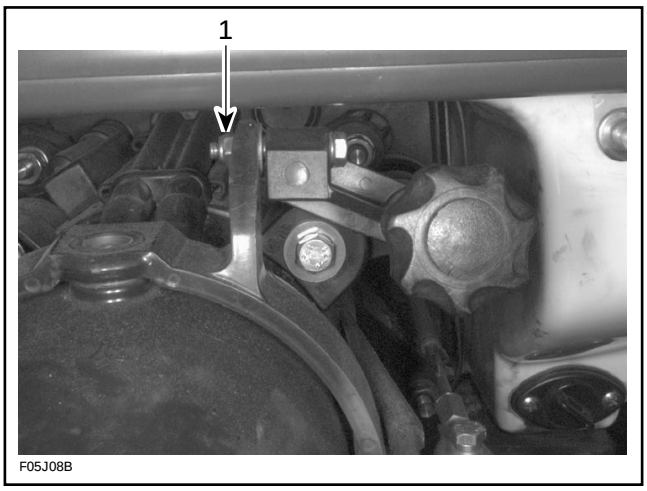


1. *Torque nut to 10 N•m (89 lbf•in)*

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SPI and HX Models

Secure support of manual trim.



1. Torque nut to 10 N•m (89 lbf•in)

All Models

NOTE : Ball joint must be parallel. If not, loosen jam nut and adjust ball joint. Torque jam nut to 2.5 N•m (23 lbf•in).

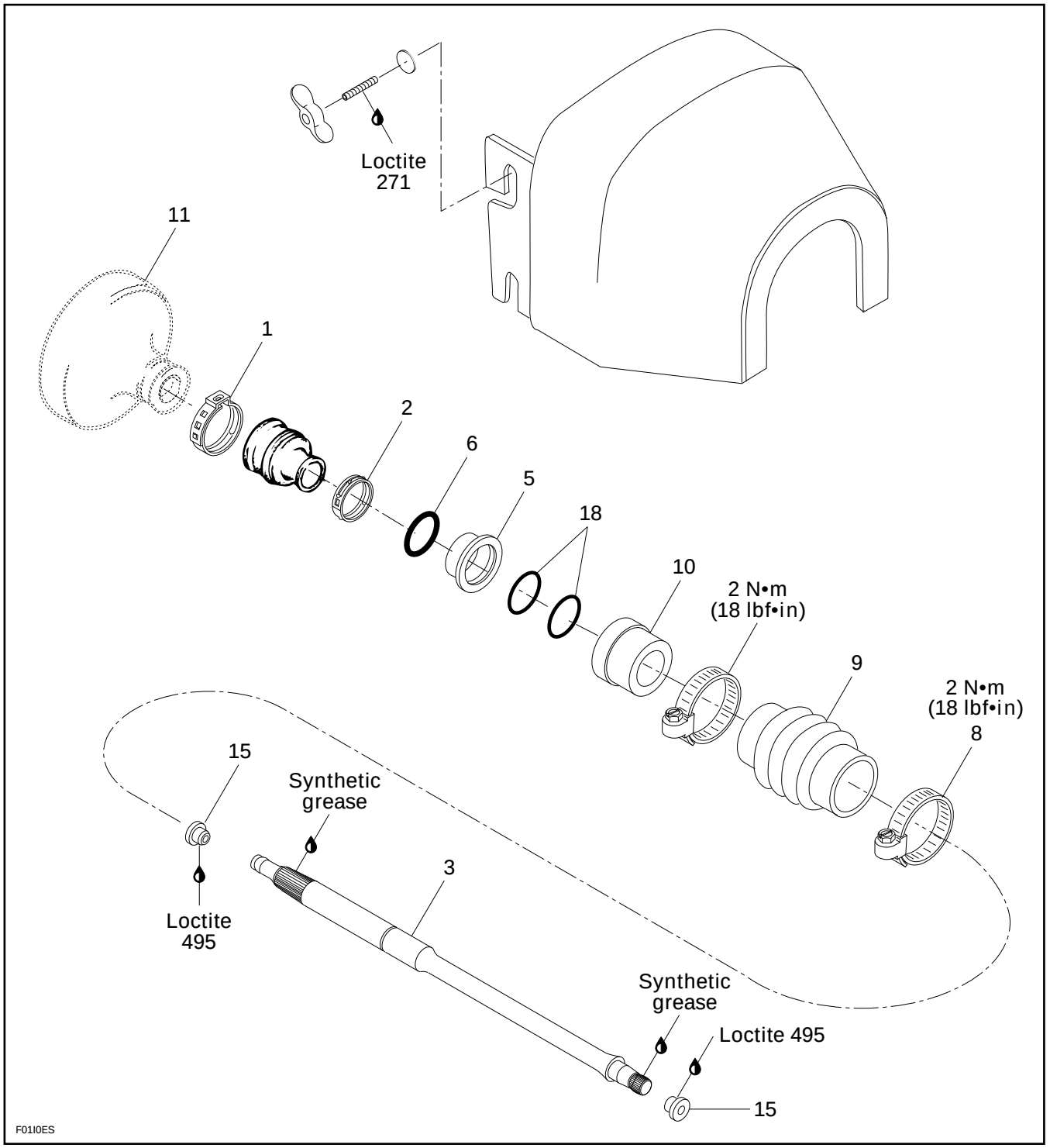
Check steering alignment. Refer to STEERING SYSTEM 10-04.

Slightly lubricate wear ring with BOMBARDIER LUBE lubricant before starting to minimize friction during initial start.

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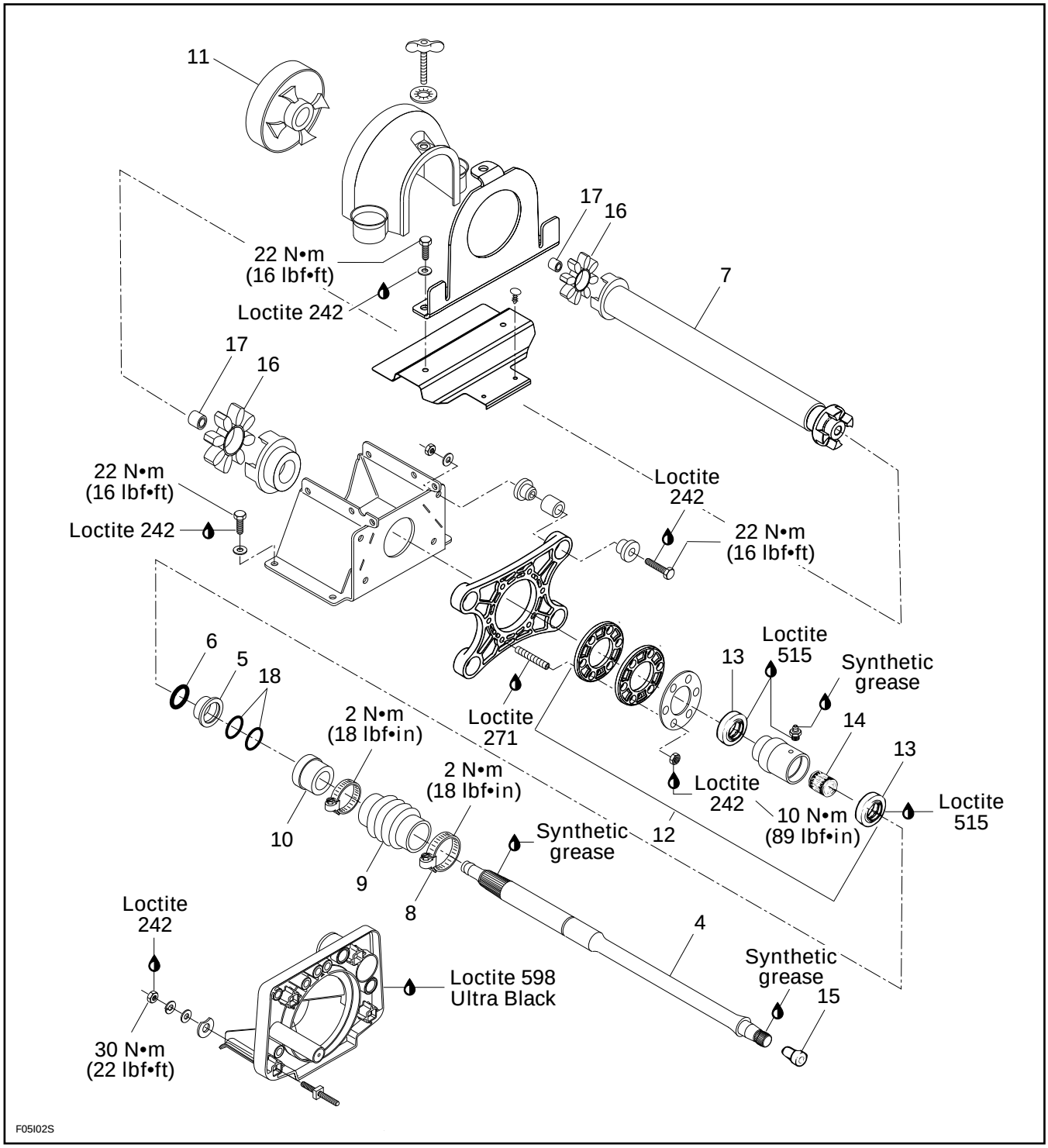
DRIVE SYSTEM

All Models Except HX



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HX Model



PARTS
www.SeaDooManuals.net

GENERAL

Jet pump must be removed to replace any components of the drive system. Refer to PROPULSION SYSTEM 09-01 for jet pump removal procedure.

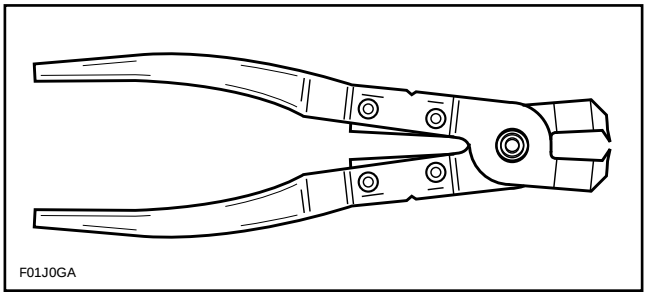
REMOVAL

All Models Except the HX

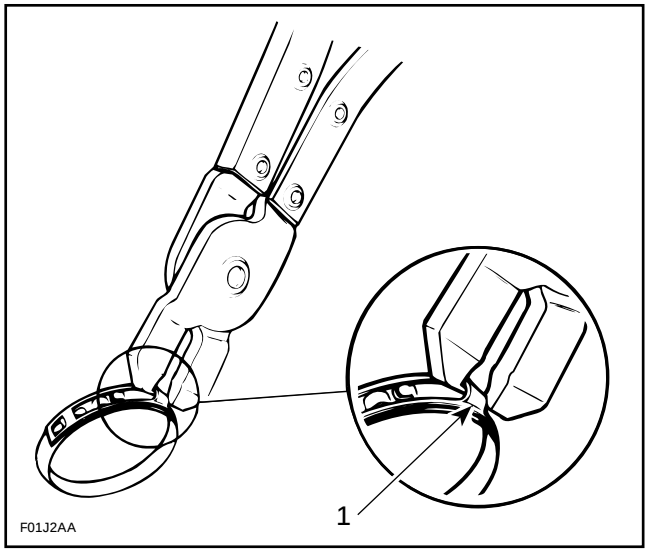
1, Large Clamp

Unfasten large clamp of PTO flywheel boot as follows :

– Use pliers (P / N 295 000 069).



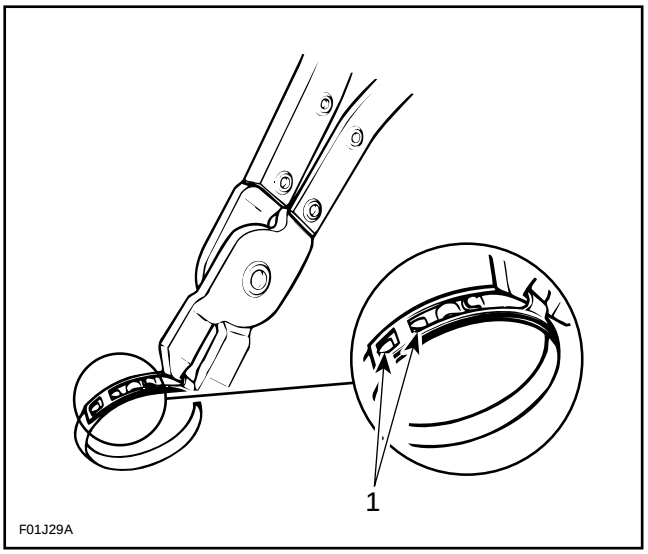
– Insert pointed tips of pliers in closing hooks.



TYPICAL

1. Closing hooks

– Squeeze pliers to draw hooks together and disengage windows from locking hooks.



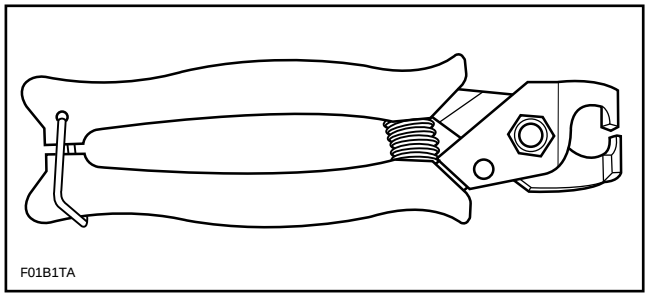
TYPICAL

1. Locking hooks

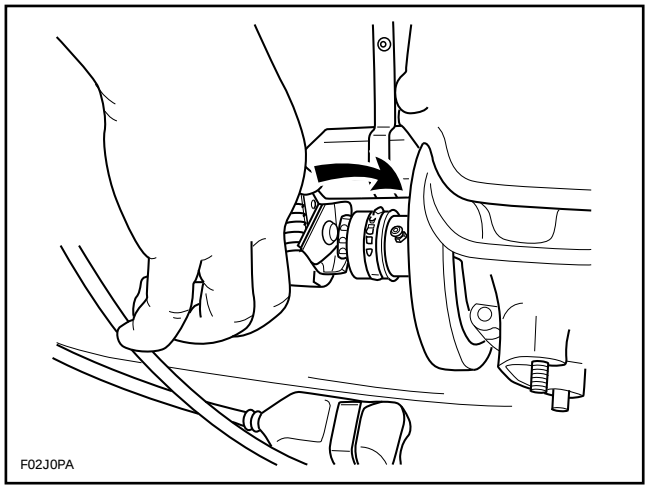
2, Small Clamp

Unfasten small clamp of PTO flywheel boot as follows :

Use pliers (P / N 295 000 054).



To open clamp, place flat side of plier on clamp embossment, squeeze and twist plier.



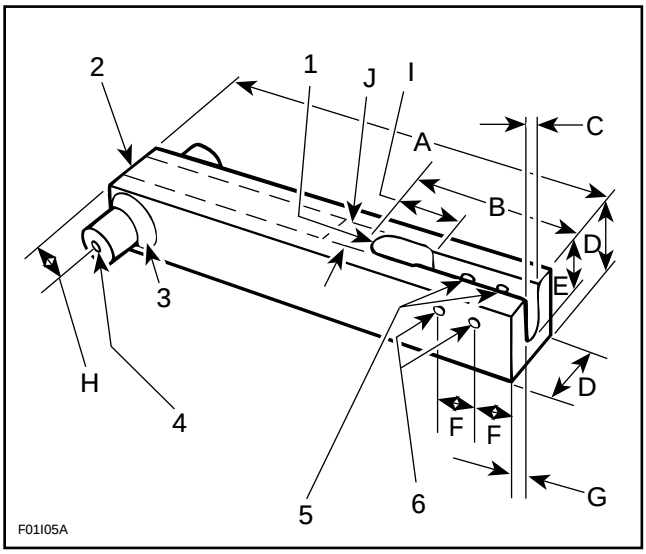
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3, Drive Shaft

If the drive shaft is jammed into PTO flywheel, make the following tool and use it in conjunction with impeller housing remover (P / N 295 000 113) to withdraw drive shaft.

Raw Material :

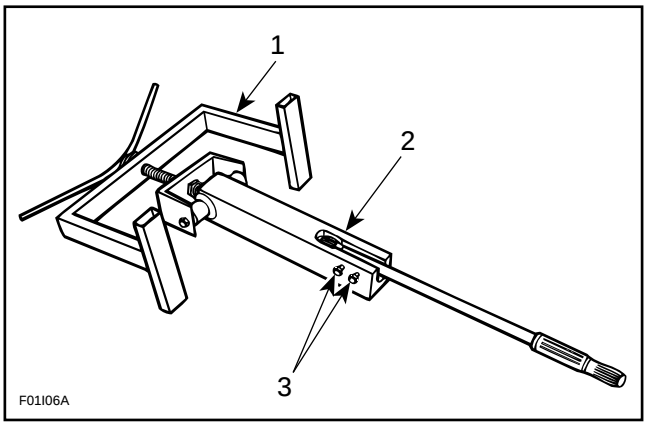
– 1 aluminum alloy square of 51 mm (2 in) x 305 mm (12 in).
– 2 aluminum rods of 28.5 mm (1-1/8 in) dia. x 30 mm (1-3/16 in).



1. *Use ball end mill for radius. This section of the slot should be 38 mm (1-15/32 in) deep*
2. *Drill 25 mm (1 in) hole in center to remove material*
3. *Weld all around*
4. *Drill 9 mm (11/32 in) hole*
5. *Drill through 9 mm (11/32 in)*
6. *Drill and tap 6 mm (1/4 in) holes*

A. 305 mm (12 in)
B. 105 mm (4-1/8 in)
C. 16 mm (5/8 in)
D. 51 mm (2 in)
E. 36 mm (1-25/64 in)
F. 22 mm (7/8 in)
G. 17 mm (43/64 in)
H. 19 mm (3/4 in)
I. 35 mm (1-3/8 in)
J. 20.3 ± .18 (.800 in ± .007)

Mount on drive shaft puller the impeller housing remover ; then, install assembly on drive shaft using screws.



TYPICAL

1. *Impeller housing remover*
2. *Drive shaft puller*
3. *Screws*

▼ CAUTION : Be careful not to damage hull rear section or engine rubber mounts.

HX Model Only

4, Rear Drive Shaft

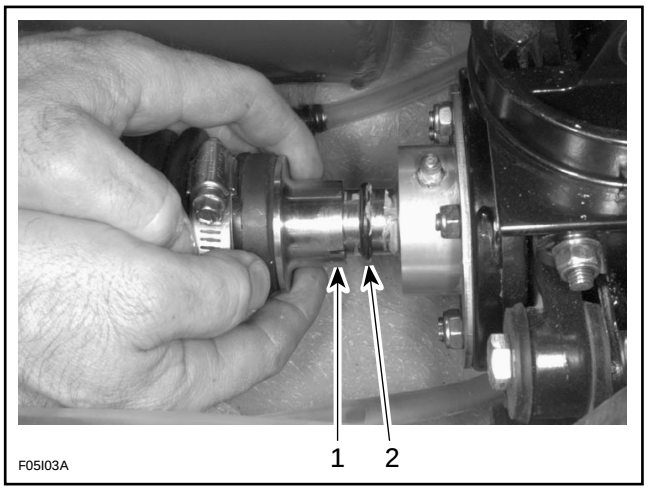
Remove rear access panel from body.

Remove muffler. Refer to ENGINE 04-05 for proper procedure.

Remove coil over shock. Refer to SUSPENSION 11-01 for proper procedure.

5,6, Floating Ring and O-ring

Hold floating ring and compress protective hose ; then, pull out O-ring from driveshaft groove.



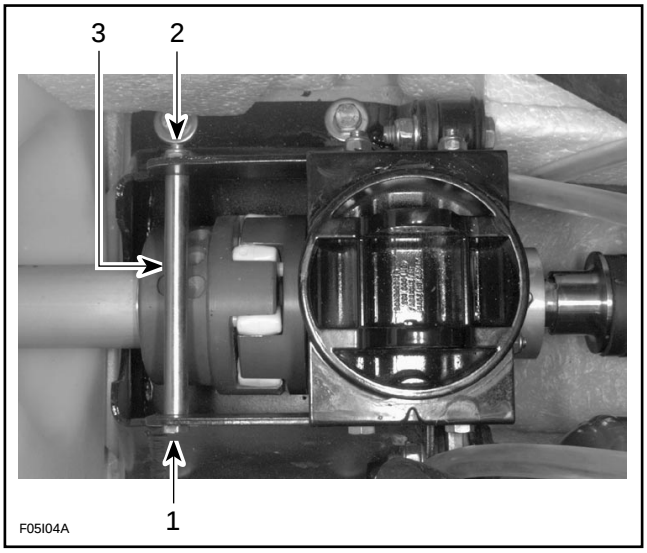
1. *Floating ring*
2. *O-ring*

Pull out rear drive shaft.

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7, Front Drive Shaft

Remove bolt, lock nut and sleeve from support.

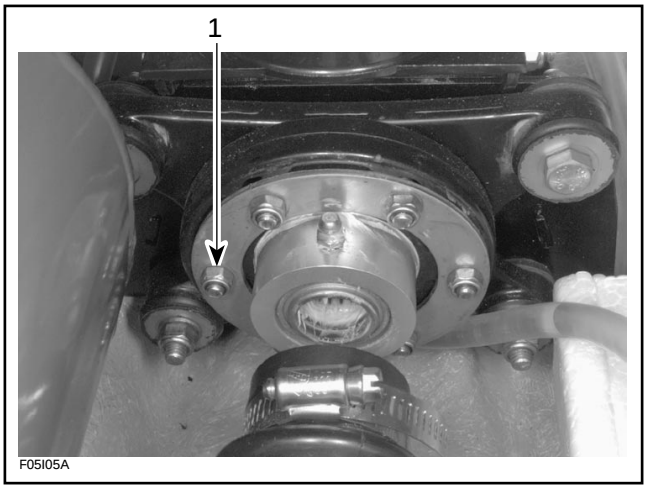


1. *Bolt*
2. *Lock nut*
3. *Sleeve*

Remove front drive shaft.

12, Seal Carrier

To remove the seal carrier from support, loosen the 6 nuts.



1. *Nut (6)*

All Models

8,9,10, Clamp, Protective Hose and Carbon Ring

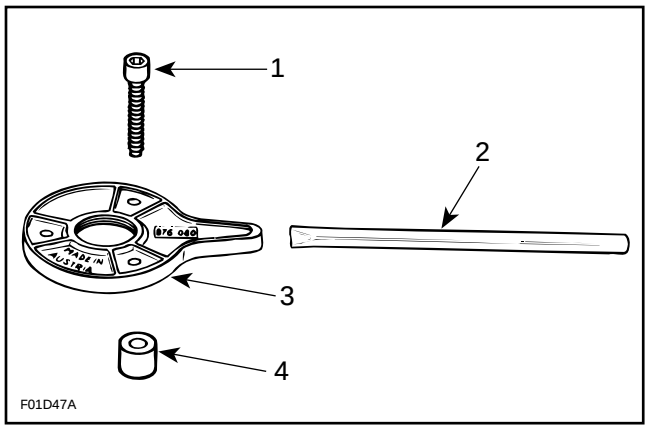
Loosen gear clamp holding protective hose, then carefully pull hose and carbon ring from hull insert.

11, PTO Flywheel

Remove magneto housing cover. Refer to ELECTRICAL SYSTEM 08-01.

All Models Except XP

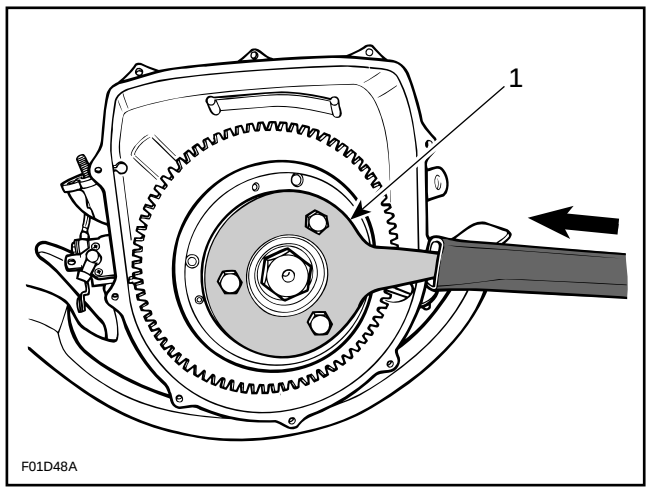
To remove PTO flywheel, magneto is locked with puller plate (P / N 290 876 080), sleeves (P / N 290 847 220) and extension handle (P / N 295 000 111).



1. *Screw*
2. *Extension handle*
3. *Puller plate*
4. *Sleeve*

Using 3 M8 x 35 screws (P / N 290 841 591), install screws through puller plate and slide sleeves on screws then secure puller plate on magneto so that sleeves are against flywheel.

Install extension handle on end of puller plate.



TYPICAL

1. *Sleeves on opposite side*

XP Model Only

Remove starter. Refer to ELECTRICAL SYSTEM 08-04.

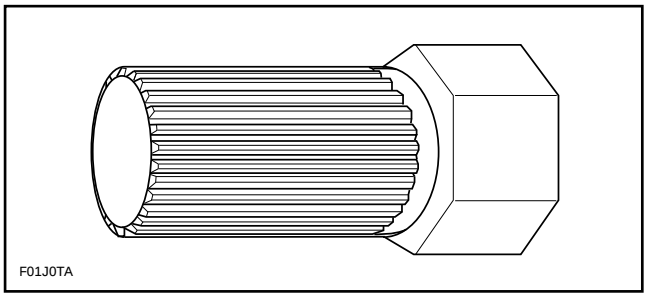
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Lock ring gear using special tool (P / N 295 000 134).

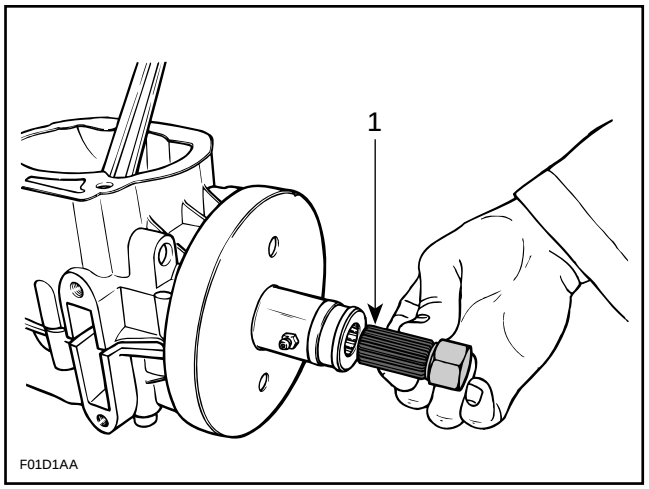
1. Ring gear blocking tool

All Models Except HX

PTO flywheel is loosen using PTO flywheel remover (P / N 295 000 001).



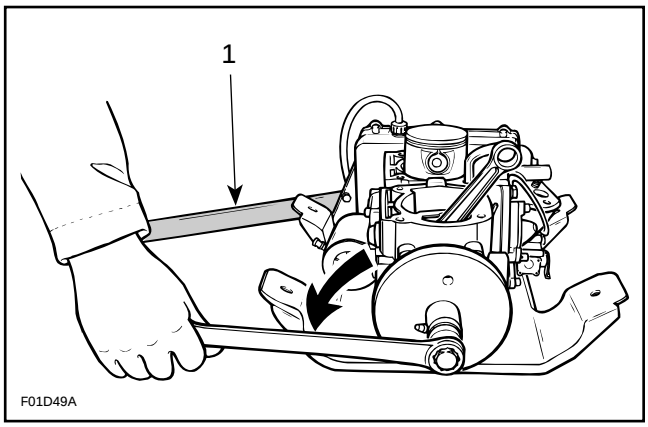
Insert special tool in PTO flywheel splines.



TYPICAL

1. PTO flywheel remover (P / N 295 000 001)

Using a suitable wrench or socket, unscrew PTO flywheel COUNTERCLOCKWISE when facing it.

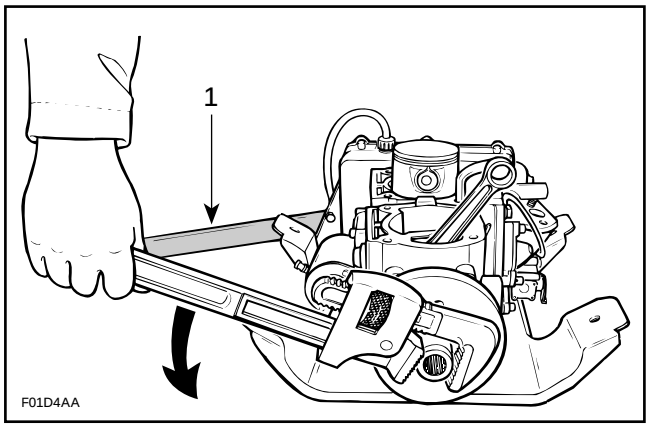


TYPICAL

1. Extension handle locking crankshaft

As an alternate method to remove PTO flywheel when splines are worn out and PTO flywheel remover cannot be used.

Use a pipe wrench and install it on PTO flywheel as illustrated.



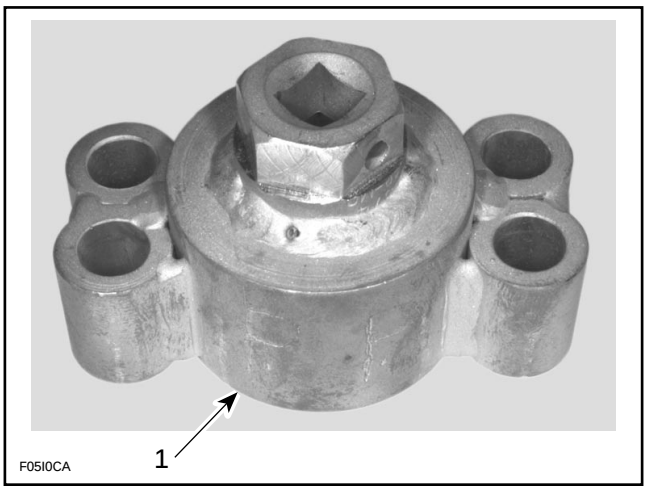
TYPICAL

1. Extension handle locking crankshaft

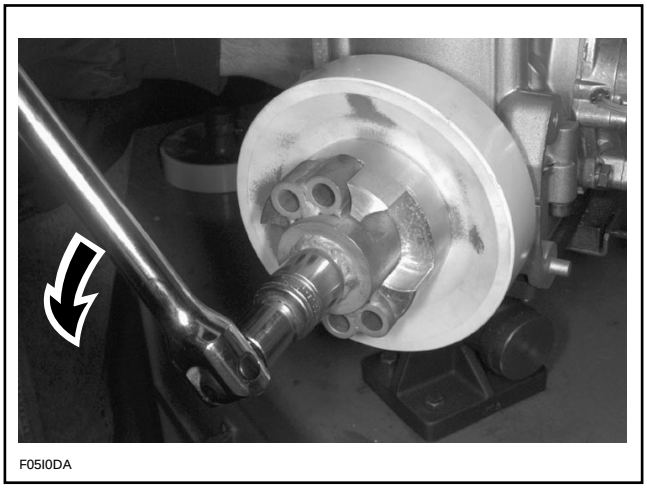
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HX Model Only

PTO flywheel is loosen using flywheel remover.



1. PTO flywheel remover



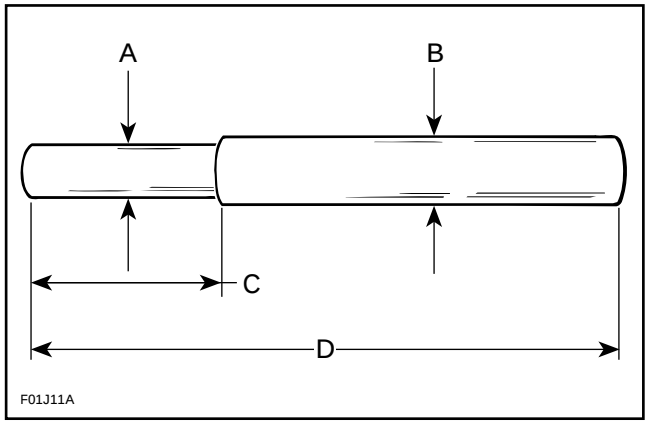
DISASSEMBLY

HX Model Only

13,14, Seal and Needle Bearing

To remove seals and bearing, use a 30 mm (1-1/8 in) diameter by 345 mm (13-1/2 in) long steel shaft. Machine shaft as per the following drawing.

NOTE : The same tool is used for bearing and seal removal of jet pump.



A. 22 mm (.865 in) dia.
B. 28 mm (1.115 in) dia.
C. 90 mm (3-1/2 in)
D. 345 mm (13-1/2 in)

Properly support seal carrier when removing seals and bearing.

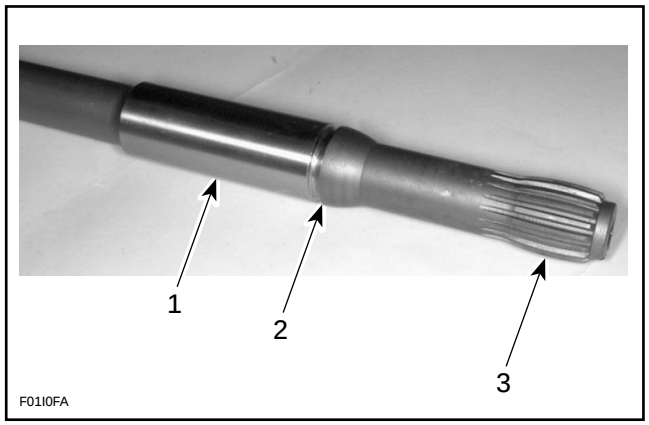
PARTS INSPECTION

3, Drive Shaft

Inspect condition of splines.

Inspect condition of groove.

With your finger nail, feel contact surface of floating ring. If any irregular surface is found, renew drive shaft.



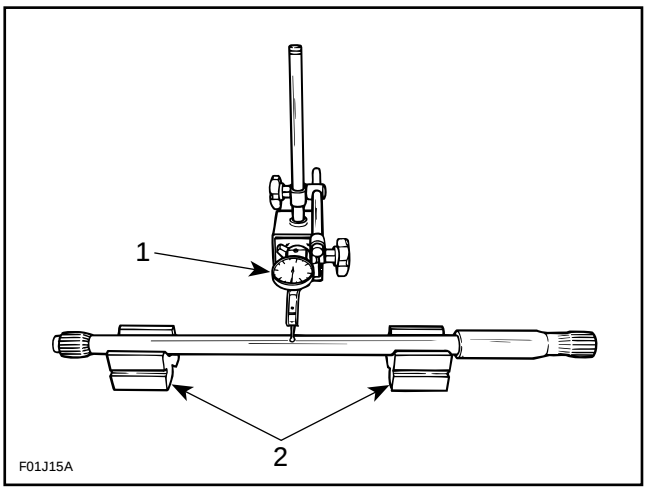
1. Floating ring contact surface
2. Groove condition
3. Splines condition

Excessive deflection could cause vibration and damage to drive shaft splines, impeller, flywheel or floating ring.

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Place drive shaft on V-blocks and set-up a dial gauge in center of shaft. Slowly rotate shaft ; difference between highest and lowest dial gauge reading is deflection. Refer to the following illustration.

Maximum permissible deflection is 0.5 mm (.020 in).



MEASURING DRIVE SHAFT DEFLECTION

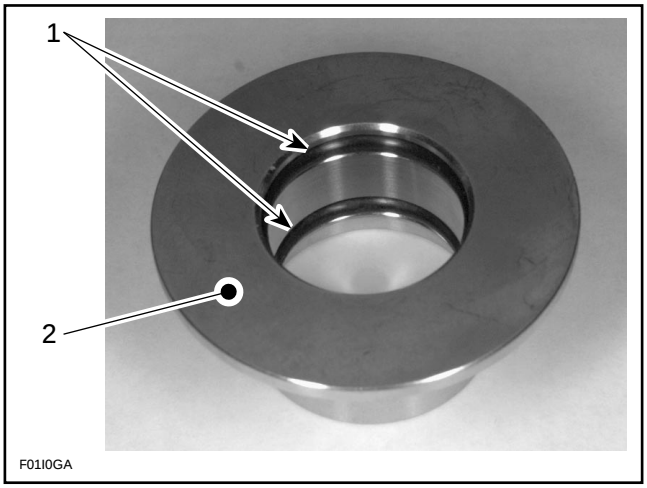
1. *Dial gauge*
2. *V-blocks*

15, Damper

Visually inspect shape of dampers for deformation or other damage.

5,18, Floating Ring and O-ring

Inspect condition of O-rings and floating ring contact surface.



1. *O-rings*
2. *Floating ring contact surface*

6, O-ring

Check also condition of drive shaft O-ring. Replace as necessary.

All Model Except HX

11, PTO Flywheel

Inspect spline condition of PTO flywheel.

NOTE : There is a possibility that when drive shaft was removed, the damper has remained in PTO flywheel. Remove it if such is the case.

HX Model Only

4,14, Drive Shaft and Needle Bearing

Inspect seal carrier needle bearing and its contact surface on drive shaft. Check parts for scoring, pitting, chipping or other evidence of wear.

ASSEMBLY

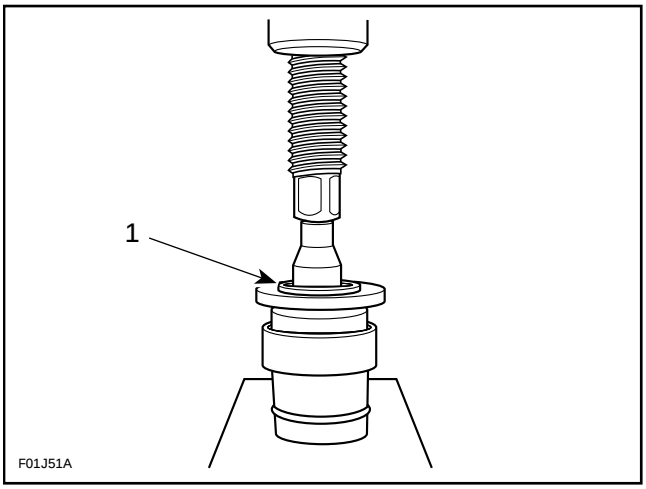
HX Model Only

14, Needle Bearing

Properly support seal carrier when installing seals and bearing.

CAUTION : Ensure to install stamped end of bearing (showing identification markings) first on tool. Never hammer the bearing into its housing.

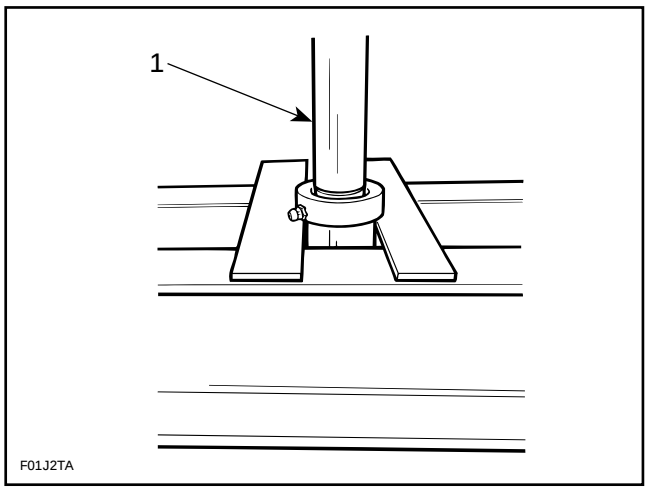
Install bearing with the bearing / seal installer tool (P / N 295 000 107).



1. *Press bearing in its housing*

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NOTE : Bearing can also be installed with the same driver used at disassembly. Center bearing in longitudinal axis of housing.

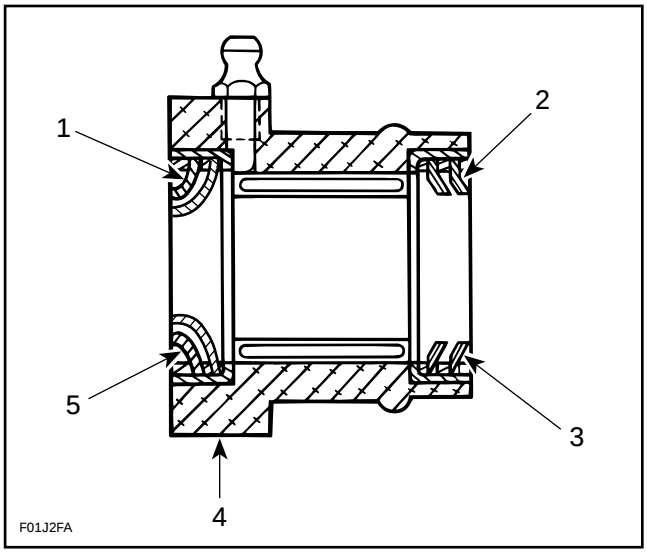


1. Push bearing centered in its housing

13, Seal

Install double-lip seal with protector toward impeller side.

On both seals, raised edge of lip must be located outwards of seal carrier.

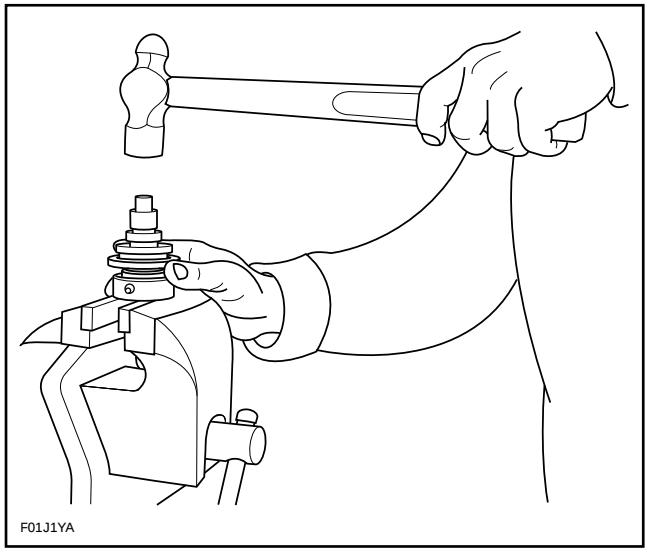


1. Double-lip seal toward engine
2. Double-lip seal with protector toward impeller
3. Raised edge of lip outwards
4. Seal carrier
5. Raised edge of lip outwards

Apply Loctite 518 all around seals outside diameter.

Seals can be carefully installed in housing using bearing / seal installer tool (P / N 295 000 107).

Push seals until tool comes in contact with housing.



TYPICAL

NOTE : Always install seal with its protector facing the impeller.

Pack seals and bearing with synthetic grease (P / N 293 550 010).

All Models Except HX

3,4,15, Drive Shaft and Damper

Install dampers on drive shaft.

NOTE : Make sure dampers were not left in PTO wheel or impeller.

Refer to PROPULSION SYSTEM 09-01 for drive shaft installation in impeller.

HX Model Only

12, Seal Carrier

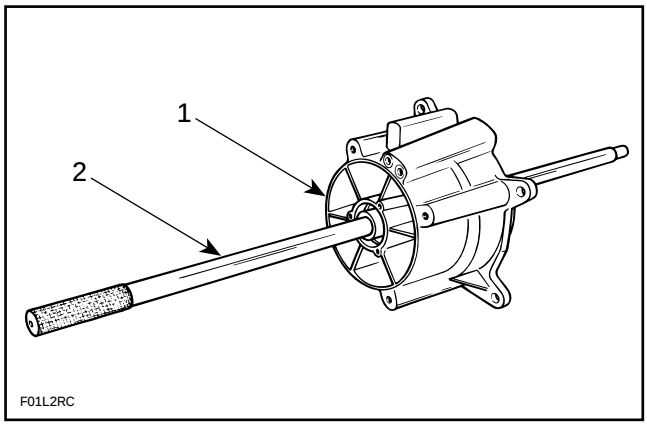
Properly index flanges together.

Install seal carrier and hand tighten nuts only.

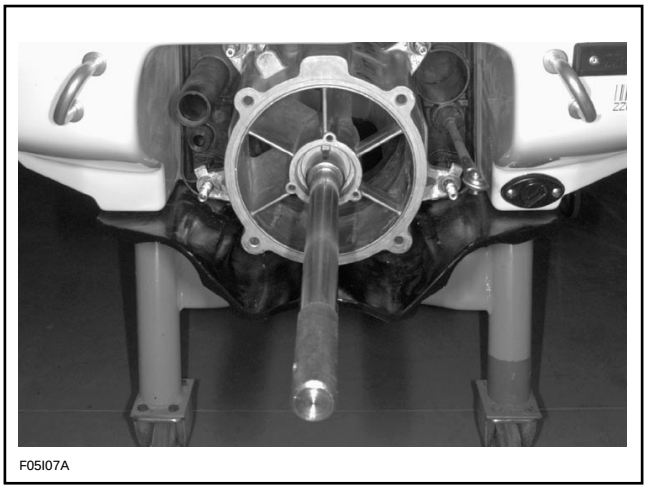
NOTE : Apply Loctite 242 (blue) on studs.

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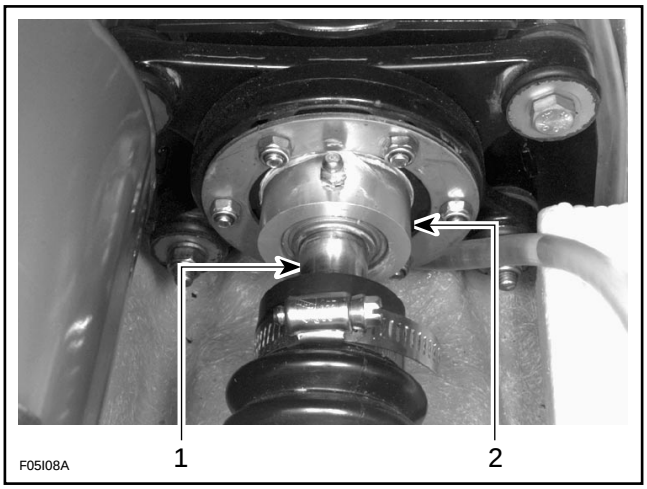
Install alignment tool at rear of watercraft.



1. Housing (P / N 295 000 090)
2. Alignment shaft (P / N 295 000 093)



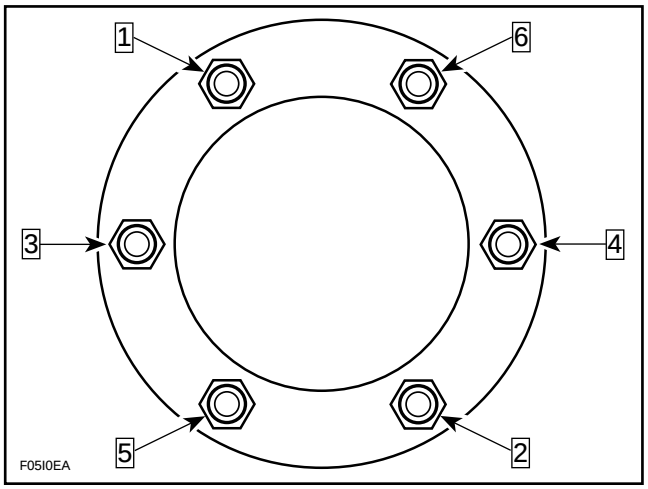
Carefully slide shaft through seal carrier.



1. Alignment tool
2. Seal carrier

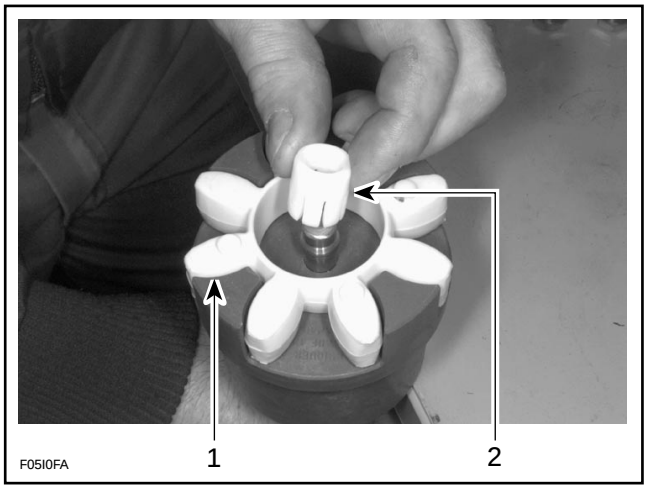
Torque seal carrier nuts to 10 N•m (89 lbf•in) in a criss-cross sequence as per following illustration.

NOTE : It is very important to tighten nuts of seal carrier in a criss-cross sequence to maintain its alignment.



4,7,16,17, Drive Shaft, Damper and Bushing

Make sure to install damper and bushing on both drive shafts.



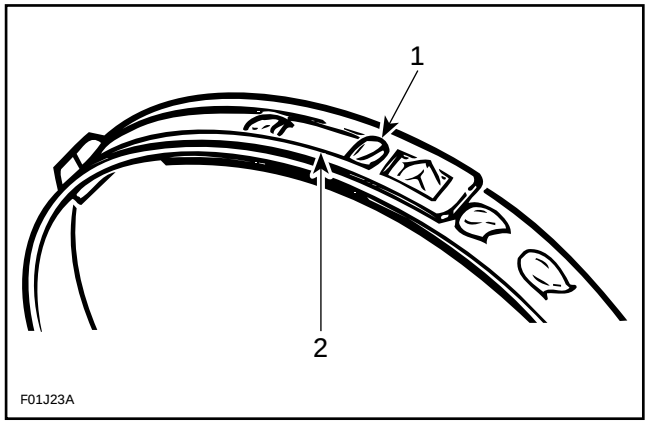
1. Damper
2. Bushing

All Models Except HX

1, Large Clamp

– Secure large clamp as follows :
– Use pliers (P / N 295 000 069) as for removal.
– Manually engage holding hook in large window. This is a pre-clamping position only.

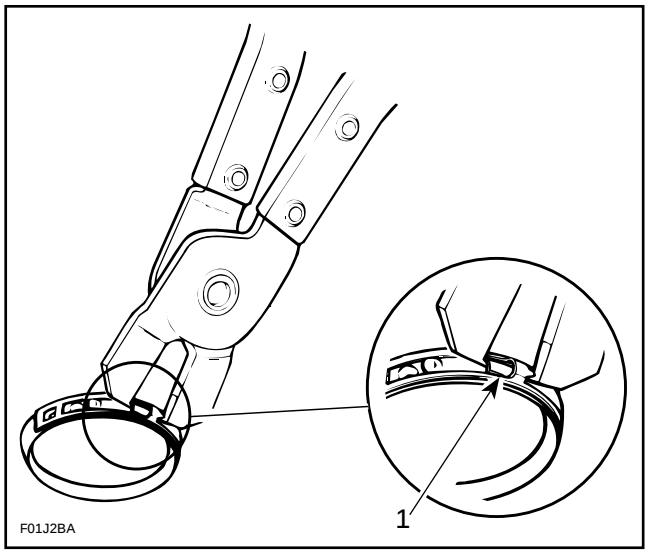
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PRE-CLAMPING POSITION

1. *Holding hook*
2. *Large window*

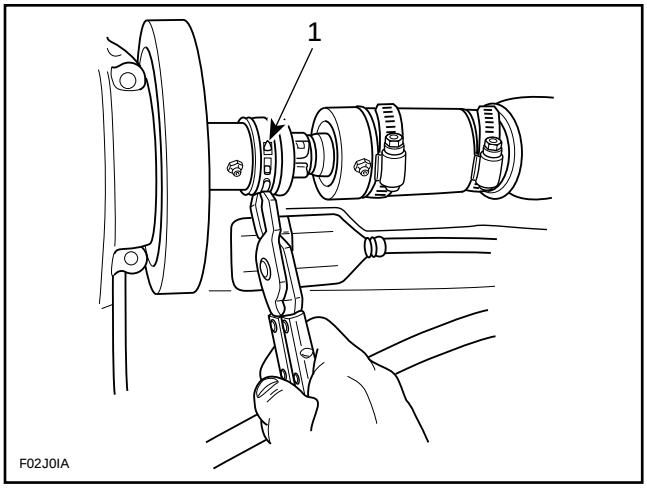
– Insert pointed tips of pliers first in closing hooks.



TYPICAL

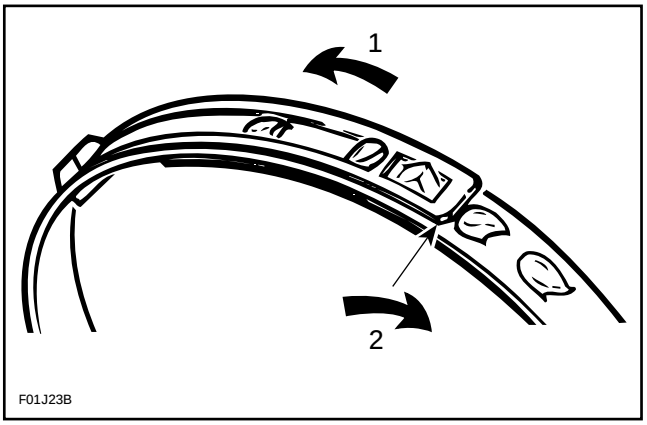
1. *Closing hooks*

– Squeeze pliers. When both large and small windows are directly over the 2 locking hooks, press those windows down to engage hooks in windows.



1. *Press to engage hooks in windows*

NOTE : At installation, clamp tail should be in opposite direction of engine rotation.

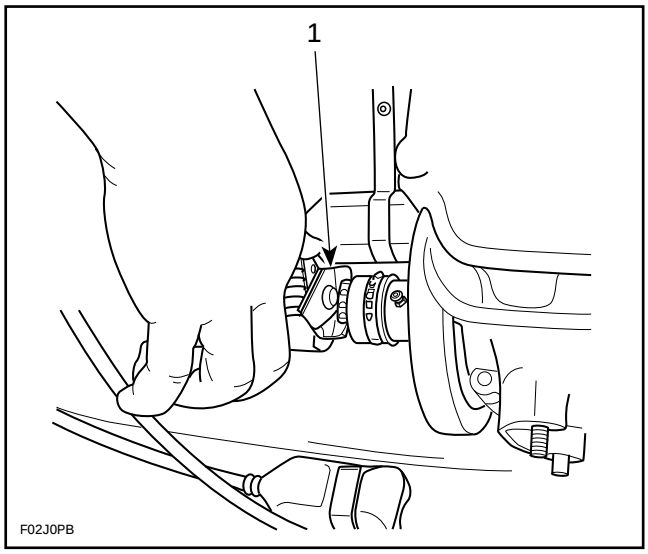


1. *Engine rotation (counterclockwise)*
2. *Tail in opposite direction*

2, Small Clamp

To secure small clamp, place notch side of plier on clamp embossment and squeeze plier.

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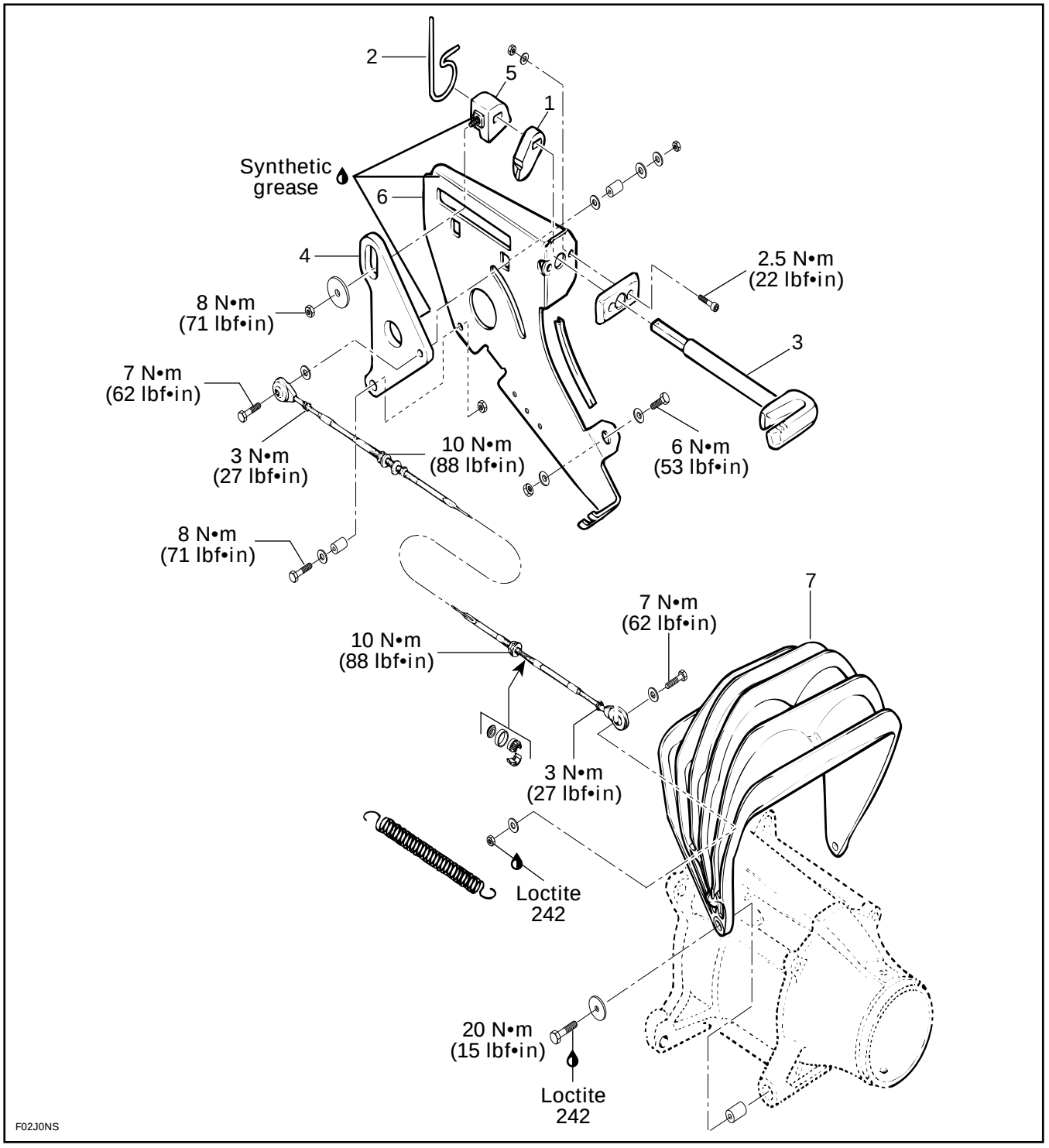


1. Squeeze plier

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REVERSE SYSTEM

GTS and GTI Models



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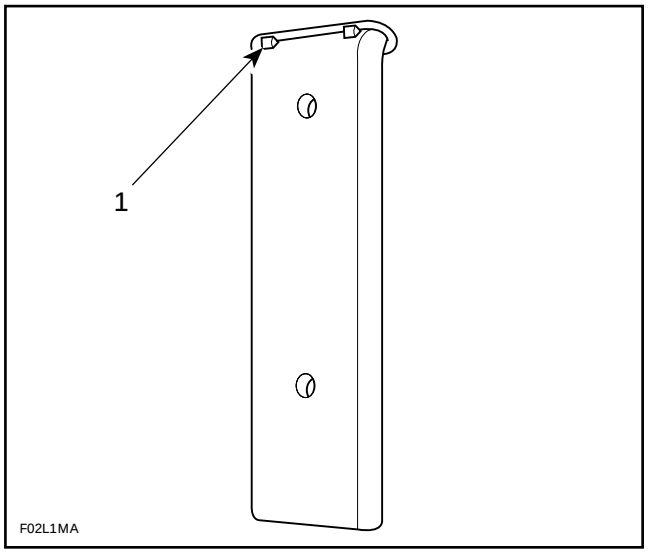
GENERAL

It is not necessary to remove reverse system from watercraft for servicing. However reverse system removal is necessary to replace reverse support.

DISASSEMBLY

Remove storage basket from watercraft.

Press on vent tube upper part to enable to withdraw tube from body.

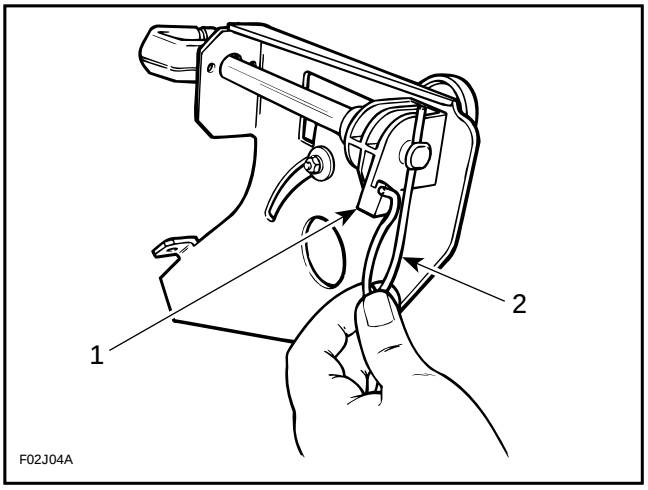


TYPICAL

1. Press on vent tube

1,2,3, Locking Lever, Spring and Selector Lever

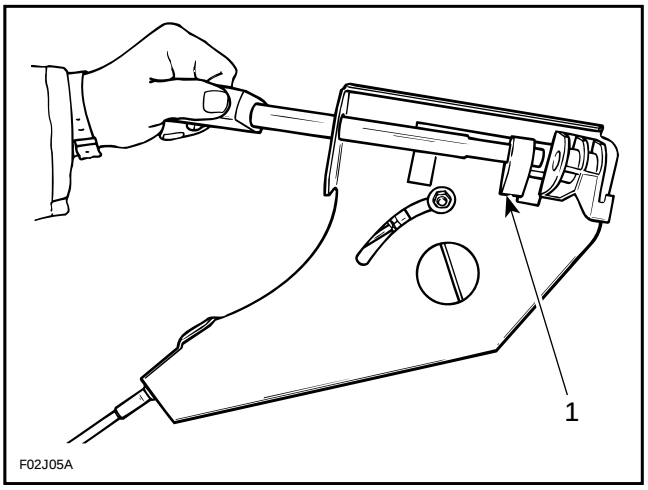
To remove selector lever, unhook spring from sliding block and pull spring from selector lever stem.



TYPICAL

1. Sliding block
2. Spring

Withdraw selector lever stem and locking lever from sliding block, then slide off locking lever from stem.



TYPICAL

1. Locking lever

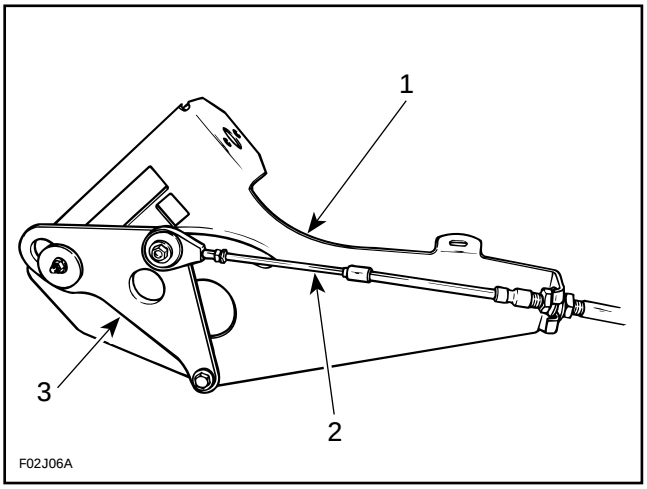
4,5, Triangular Lever and Sliding Block

Remove screw, lock nut, washers and bushing holding reverse cable to triangular lever.

Remove lock nut and washer holding sliding block to triangular lever and to support.

Remove screw, lock nut, washer and bushing holding triangular lever to reverse support.

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TYPICAL

1. *Reverse support*
2. *Reverse cable*
3. *Triangular lever*

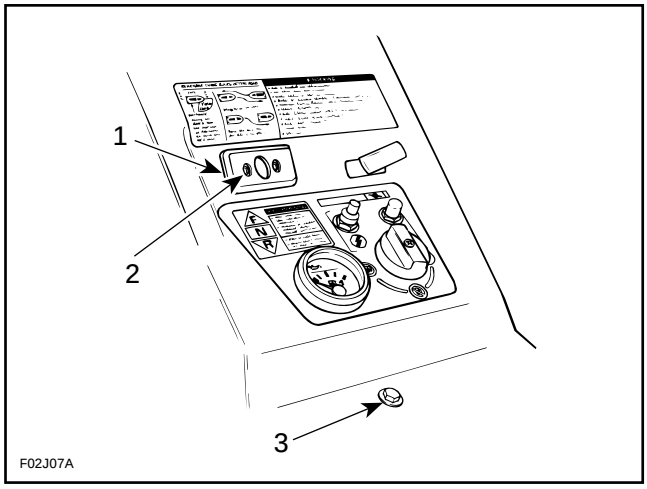
6, Reverse Support

In order to have access to screw holding lower part of reverse support, remove front seat by pulling on each side to release it from body.

Remove screw, lock nut and washers holding lower part of support.

Remove reverse cable from support.

Remove 2 Allen screws, lock nut and washer holding guide plate and support.

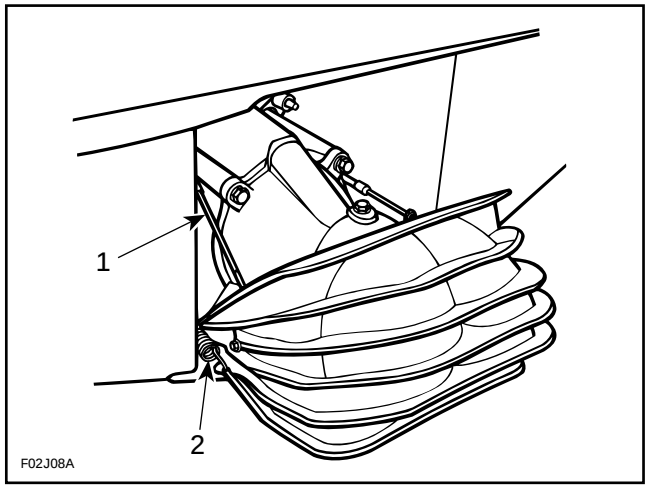


TYPICAL

1. *Guide plate*
2. *Allen screw*
3. *Screw and washer*

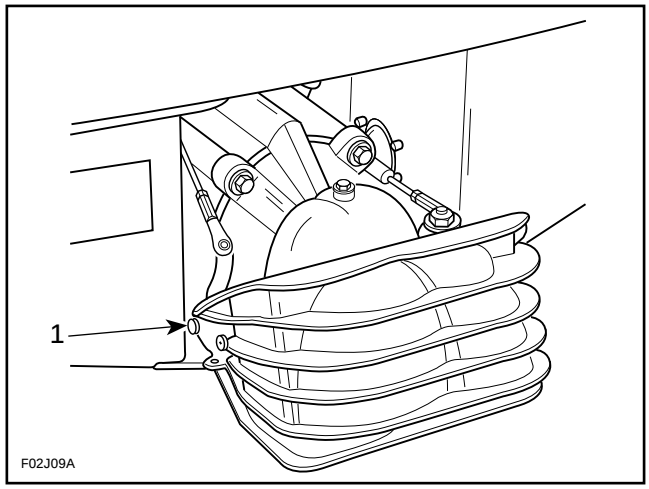
7, Reverse Gate

Unhook reverse gate springs and remove ball joint fasteners to release reverse cable from reverse gate.



1. *Reverse cable*
2. *Reverse gate spring (each side)*

Unscrew reverse gate retaining screws from venturi housing, then remove gate.



1. *Screw (each side)*

ASSEMBLY

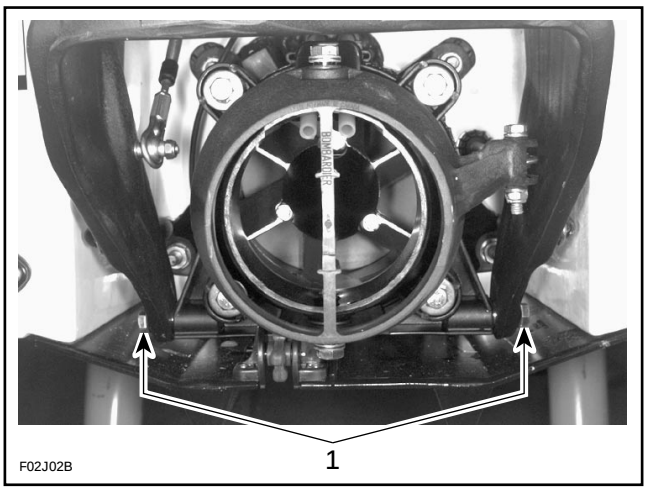
Assembly is essentially the reverse of disassembly procedures. However pay particular attention to the following.

7, Reverse Gate

Install reverse gate with sleeve and washer. Apply Loctite 242 (blue) on threads and torque to 20 N•m (15 lbf•ft).

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CAUTION : Always hook reverse gate springs in order to ease reverse gate operation.



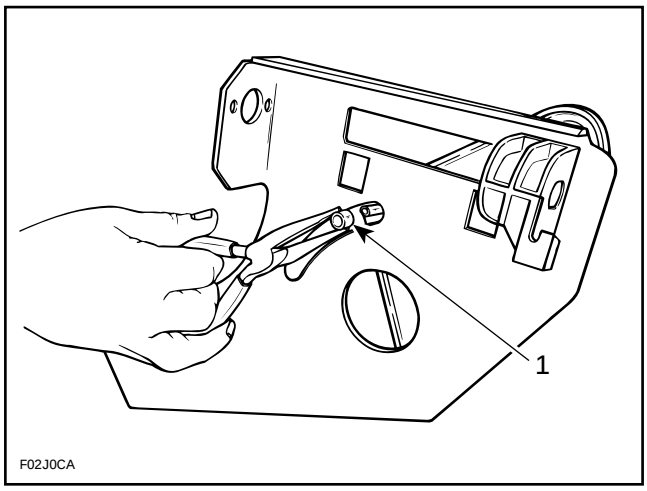
1. Screws, washers and sleeves

6, Reverse Support

For reverse support installation, torque screw to 8 N•m (71 lbf•in) and Allen screws to 2 N•m (18 lbf•in).

4,5, Triangular Lever and Sliding Block

Insert bushing in triangular lever and then install lever to reverse support.



TYPICAL
1. Bushing

Install reverse cable to triangular lever with bushing, plastic washer(s) and flat washers.

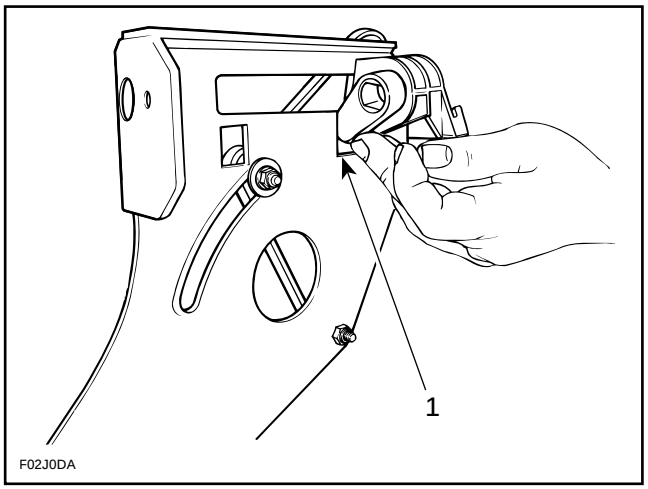
Torque cable screw to 7 N•m (62 lbf•in).

Torque triangular lever screw to 8 N•m (71 lbf•in).

Install sliding block to lever and torque nut to 8 N•m (71 lbf•in).

1,5, Locking Lever and Sliding Block

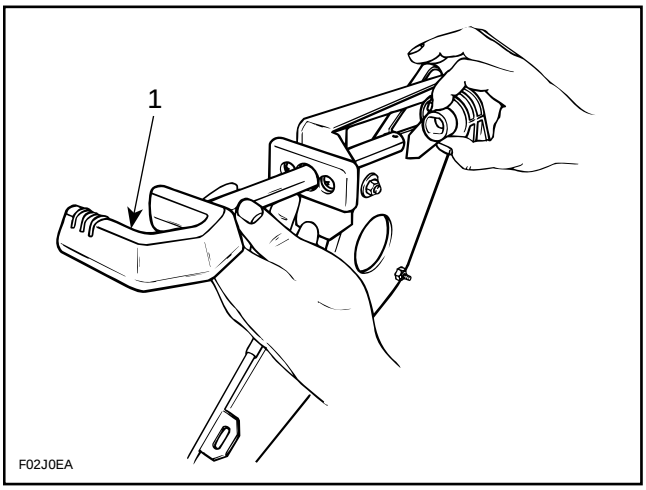
Insert locking lever end in support hole then align lever and sliding block holes.



TYPICAL
1. Support hole

1,3,5, Locking Lever, Selector Lever and Sliding Block

NOTE : Always install selector lever with its open end facing left side of watercraft, then push selector lever stem through locking lever and sliding block holes.

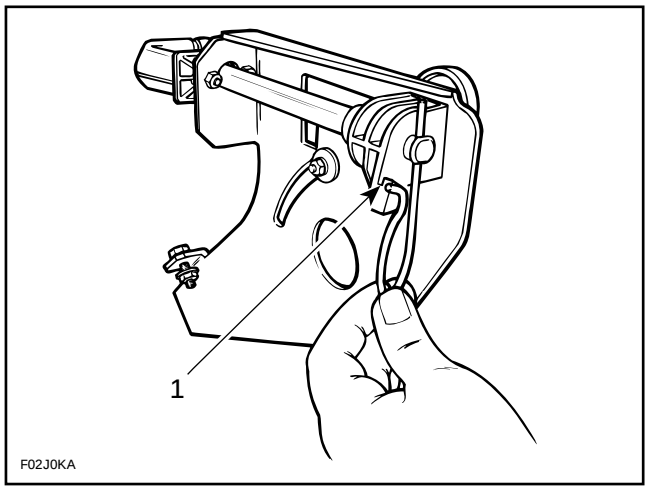


TYPICAL
1. Install lever as shown

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2, Spring

Insert spring in lever stem hole and then install curved end in sliding block groove.

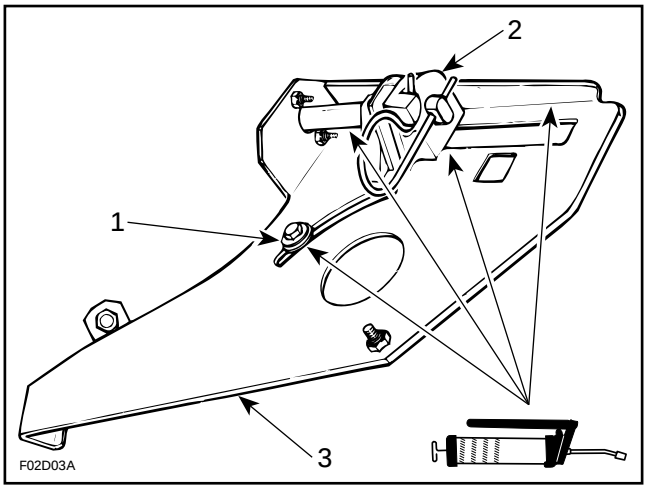


TYPICAL

1. Sliding block groove

Selector Lever System Lubrication

Lubricate sliding block support sliding area and triangular lever with synthetic grease. Also, lubricate sliding washer and selector lever stem.



TYPICAL

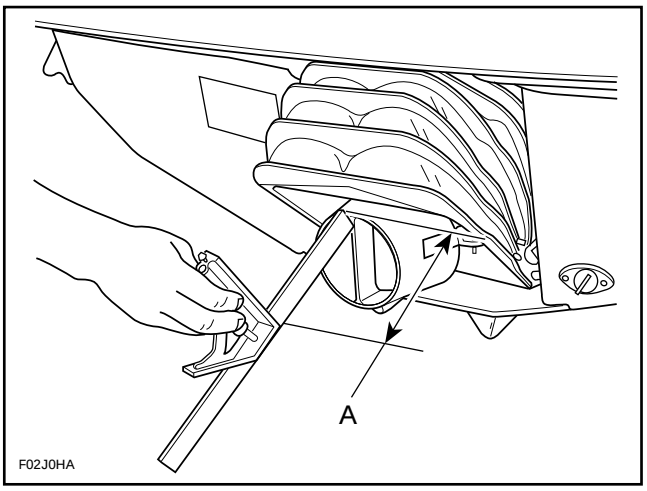
1. Sliding washer
2. Sliding block
3. Support plate

ADJUSTMENTS

Reverse Gate

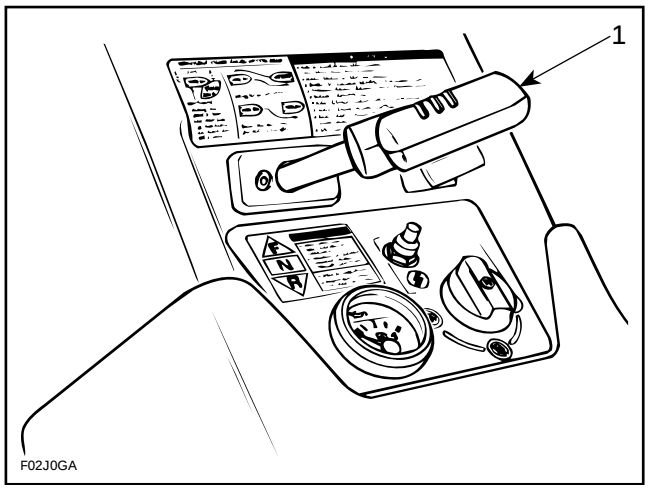
Position handlebar in a straight ahead position, nozzle should be parallel to rear of watercraft.

Using a square, set it to 129 ± 3 mm (5-5/64 ± 7/64 in), then position square end at the top middle of nozzle.



A. 129 ± 3 mm (5-5/64 ± 7/64 in)

Pull selector lever to REVERSE position.



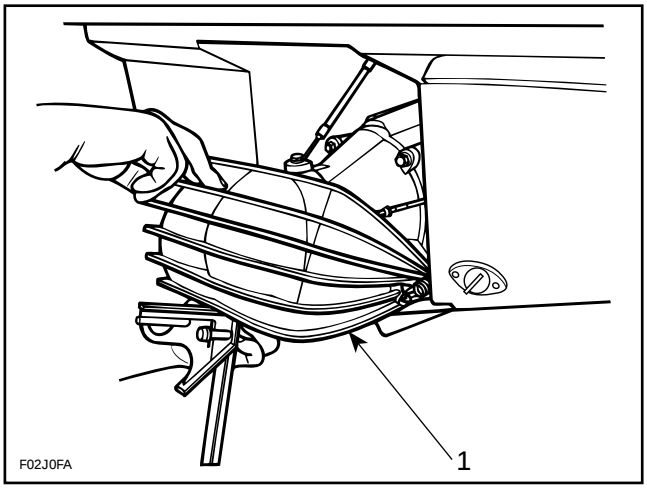
TYPICAL

1. Lever to REVERSE position

With the gate down to REVERSE position it should be at the specification.

NOTE : Push slightly on the gate in order to recover spring tension and to obtain proper position of the gate.

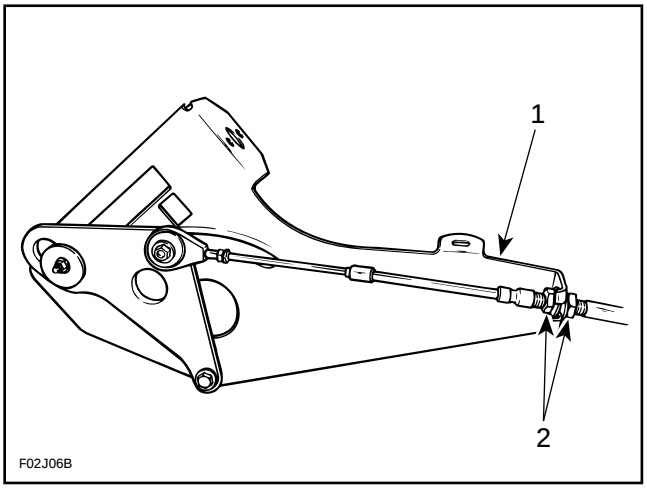
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1. REVERSE position

If reverse gate needs to be readjusted, it can be done at support with adjustment nuts. Turn cable nuts to obtain position.

NOTE : If reverse gate adjustment is not done adequately, performance and steering control will be reduced at reverse position.



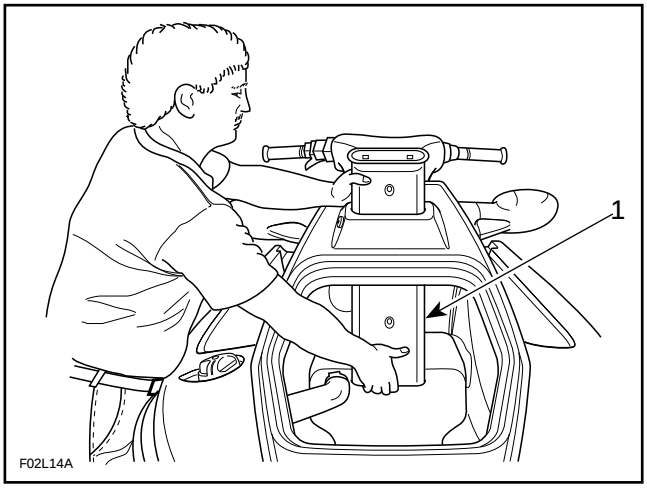
TYPICAL

1. Support
2. Adjustment nuts

Tighten adjustment nuts and recheck gate position.

Reinstall vent tube.

WARNING : Vent tube must be in place to provide proper bilge ventilation.



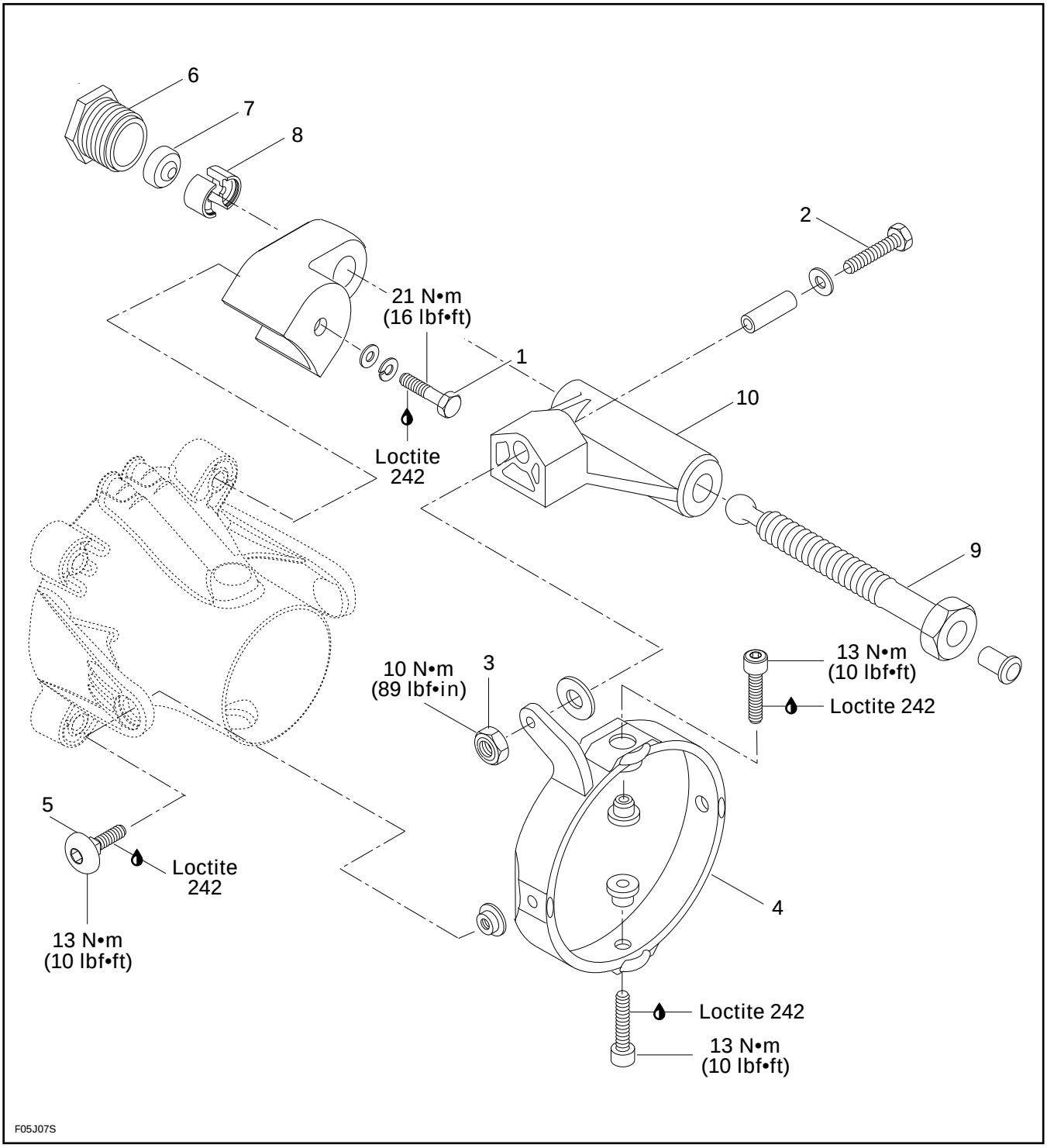
1. Install vent tube

Reinstall storage basket.

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VARIABLE TRIM SYSTEM

SPI and HX Models

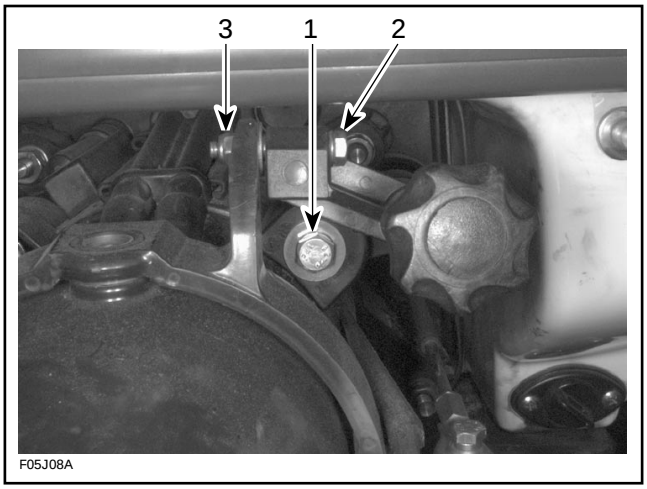


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REMOVAL

1,2,3, Screw, Bolt and Lock Nut

Loosen venturi screw, bolt and nut retaining support from trim ring.



1. *Screw*
2. *Bolt*
3. *Lock nut*

Remove manual trim.

4,5, Trim Ring and Screws

To remove trim ring / nozzle assembly from venturi, loosen side screws of trim ring.

DISASSEMBLY

6,7,8, Nut, Rubber Washer and Half Bushings

Loosen nut from support; then, remove rubber washer and half bushings.

9,10, Screw and Threaded Pivot

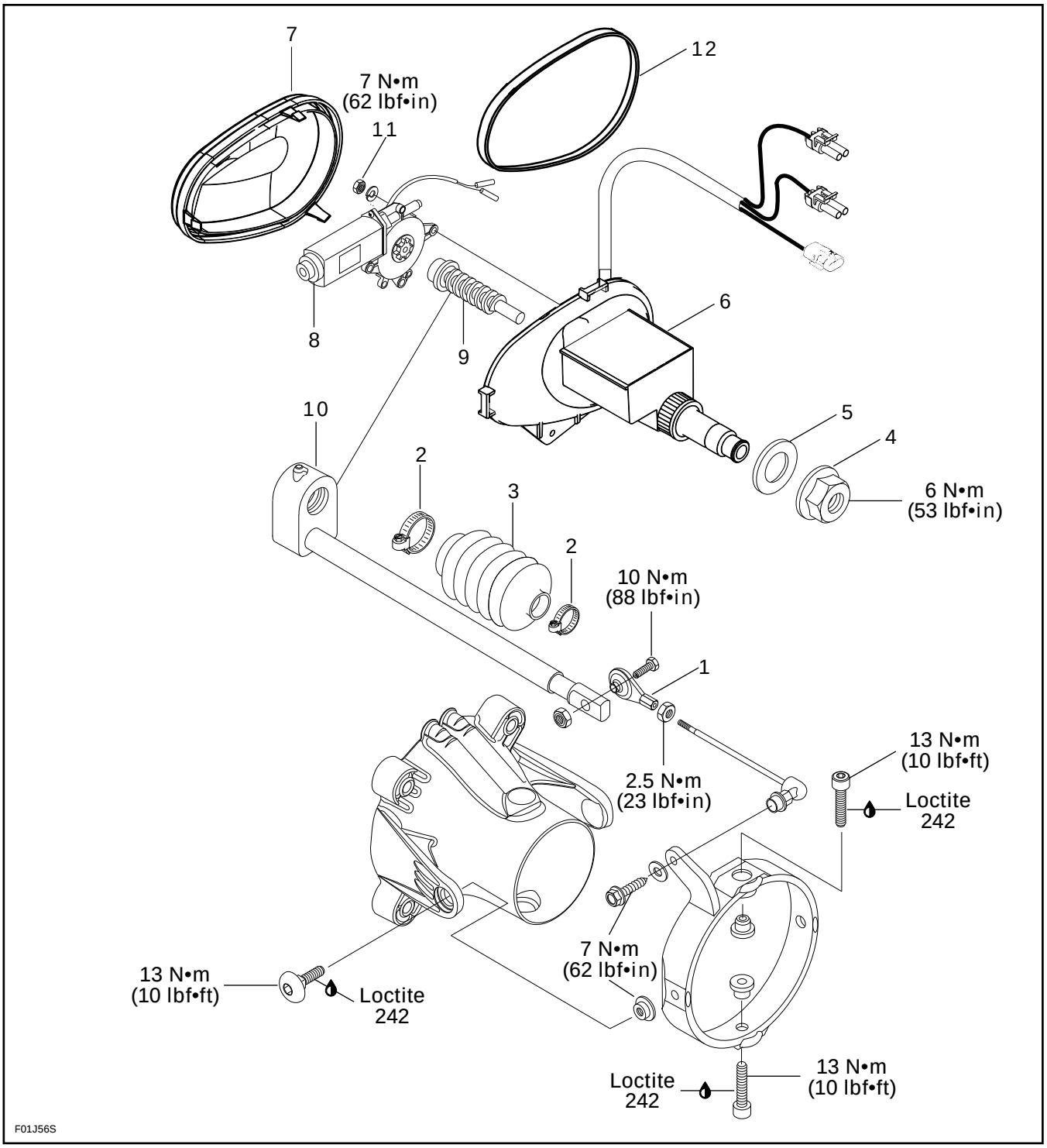
Unscrew adjustment screw to remove threaded pivot.

ASSEMBLY AND INSTALLATION

Assembly and installation are essentially the reverse of removal and disassembly procedures. For torque specifications and service products to be used, refer to the main illustration at the beginning of this sub-section.

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SPX and XP Models



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GENERAL

To test VTS control module, motor or switch, refer to ELECTRICAL SYSTEM 08-05.

REMOVAL

1,2,3, Ball Joint, Boot and Gear Clamp

Disconnect ball joint of link rod.

Loosen gear clamps of boot.

RRemove boot.

4,5, Nut and Seal

To loosen nut, use VTS socket tool (P / N 295 000 133).

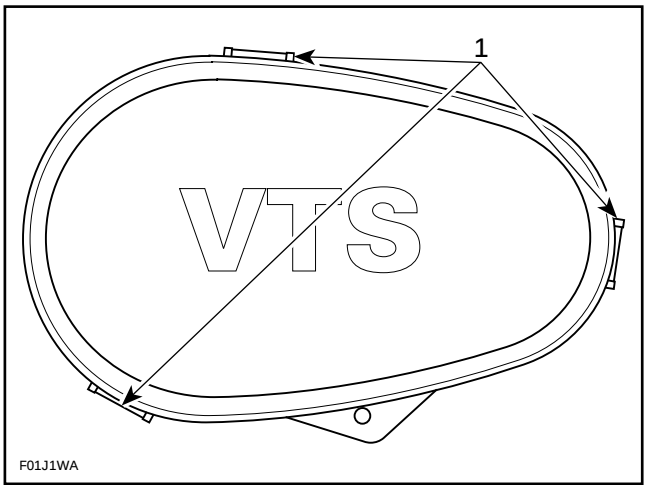
6, VTS Assembly

From bilge, pull out VTS assembly.

DISASSEMBLY

7, Cover

Remove VTS cover by pressing on tabs.

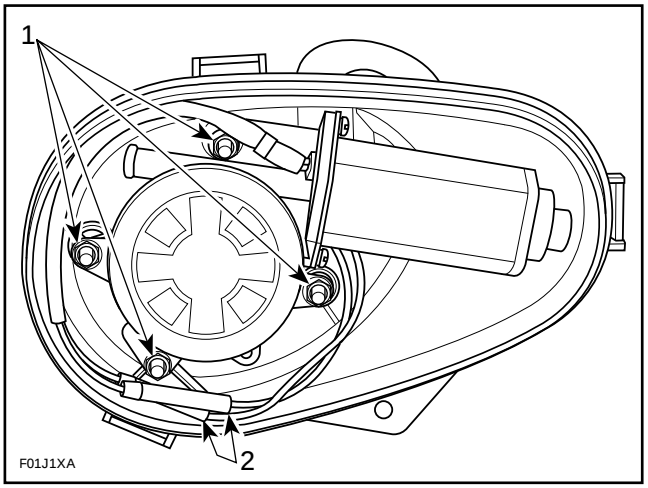


1. Press tabs to remove cover

8, Motor

Disconnect wires of motor.

Remove retaining nuts.



1. Remove nuts
2. Disconnect wires

Pull on motor to remove it.

9,10, Worm and Sliding Shaft

Simply pull on worm and sliding shaft in order to remove them.

INSPECTION

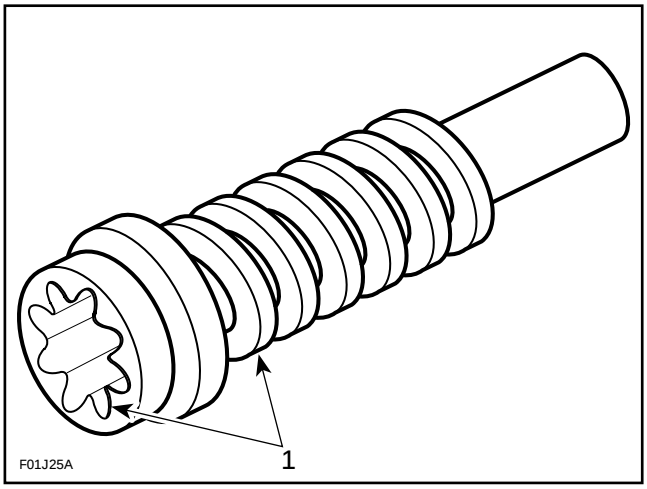
2, Boot

Make sure boot is in good condition. If it is cracked or teared, replace boot.

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9, Worm

Inspect threads and splines of worm for wear. If worm replacement is necessary, renew also sliding shaft.



1. Inspect threads and splines
2. Nuts

ASSEMBLY

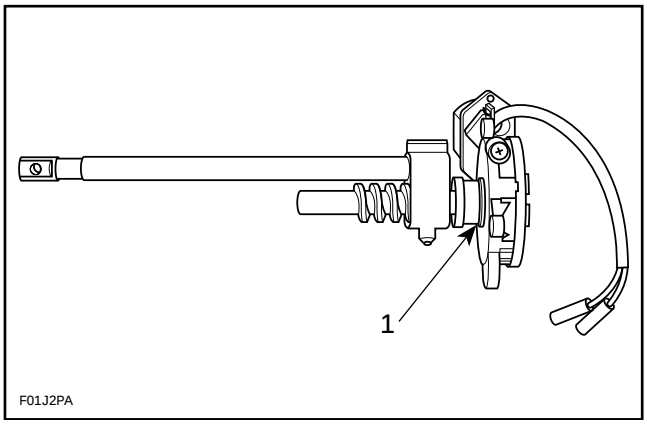
Assembly is essentially the reverse of disassembly procedures. However pay particular attention to the following.

8,9,10, Motor, Worm and Sliding Shaft

Apply synthetic grease to worm.

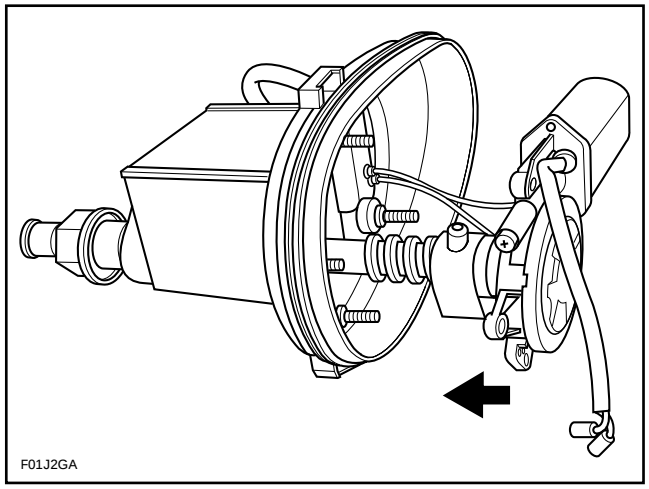
Screw worm to sliding shaft.

Mesh worm splines to gear of motor.



1. Mesh worm spline to gear of motor

Install motor, worm and sliding shaft in VTS housing.



Tighten nuts of motor to 7 N•m (62 lbf•in).

Connect wires of motor.

▼ CAUTION : Make sure wire color codes match.

Install cover.

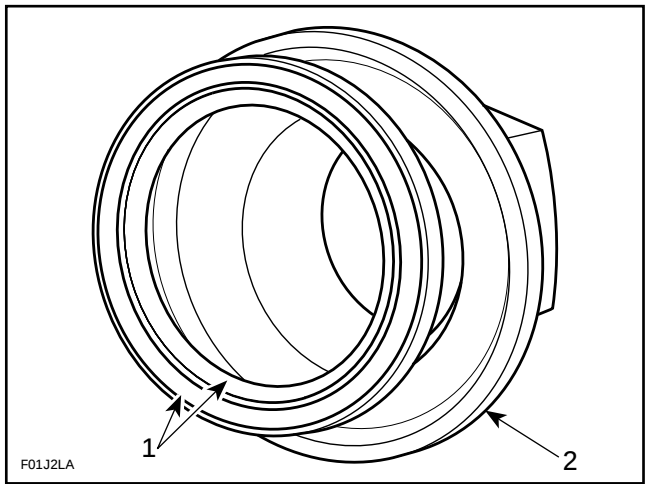
○ NOTE : Make sure seal is in place.

INSTALLATION

Installation is essentially the reverse of removal procedures. However pay particular attention to the following.

4,5, Nut and Seal

Place seal on nut. Make sure seal lips are facing toward hull.



1. Seal lips facing hull

Install nut with seal and torque to 13 N•m (10 lbf•ft) using the VTS socket tool.

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1, Ball Joint

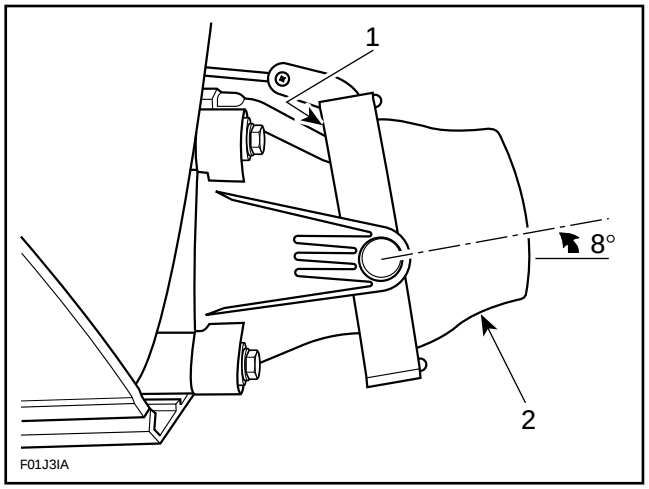
Install ball joint on right side of sliding shaft. Torque fasteners to 10 N•m (88 lbf•in).

NOTE : Install boot on sliding shaft before securing ball joint.

ADJUSTMENT

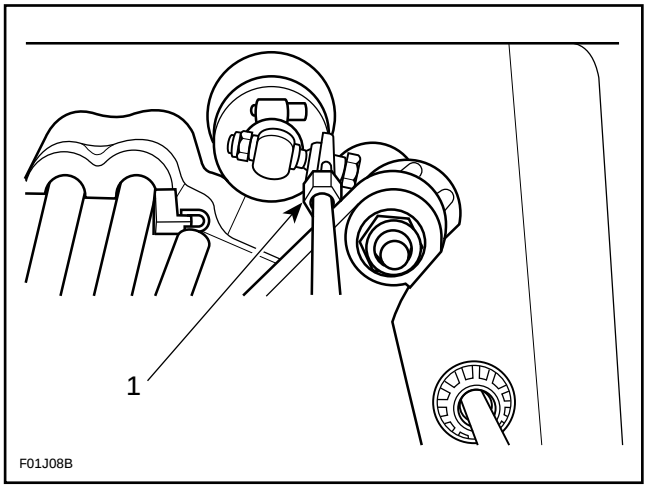
Push on VTS button up position until motor stops. When the nozzle is up (8°), nozzle edge must not interfer with venturi (there should be a gap of 1 mm (.039 in)).

NOTE : Activate timer to be able to position VTS.



1. No interference
2. Nozzle up

If an adjustment is necessary, loosen jam nut of ball joint at link rod. Turn adjustment nut of ball joint to obtain the desired gap between trim ring and venturi.



1. Turn adjustment nut of ball joint

Tighten jam nut of ball joint to 2.5 N•m (23 lbf•in) when adjustment is completed.

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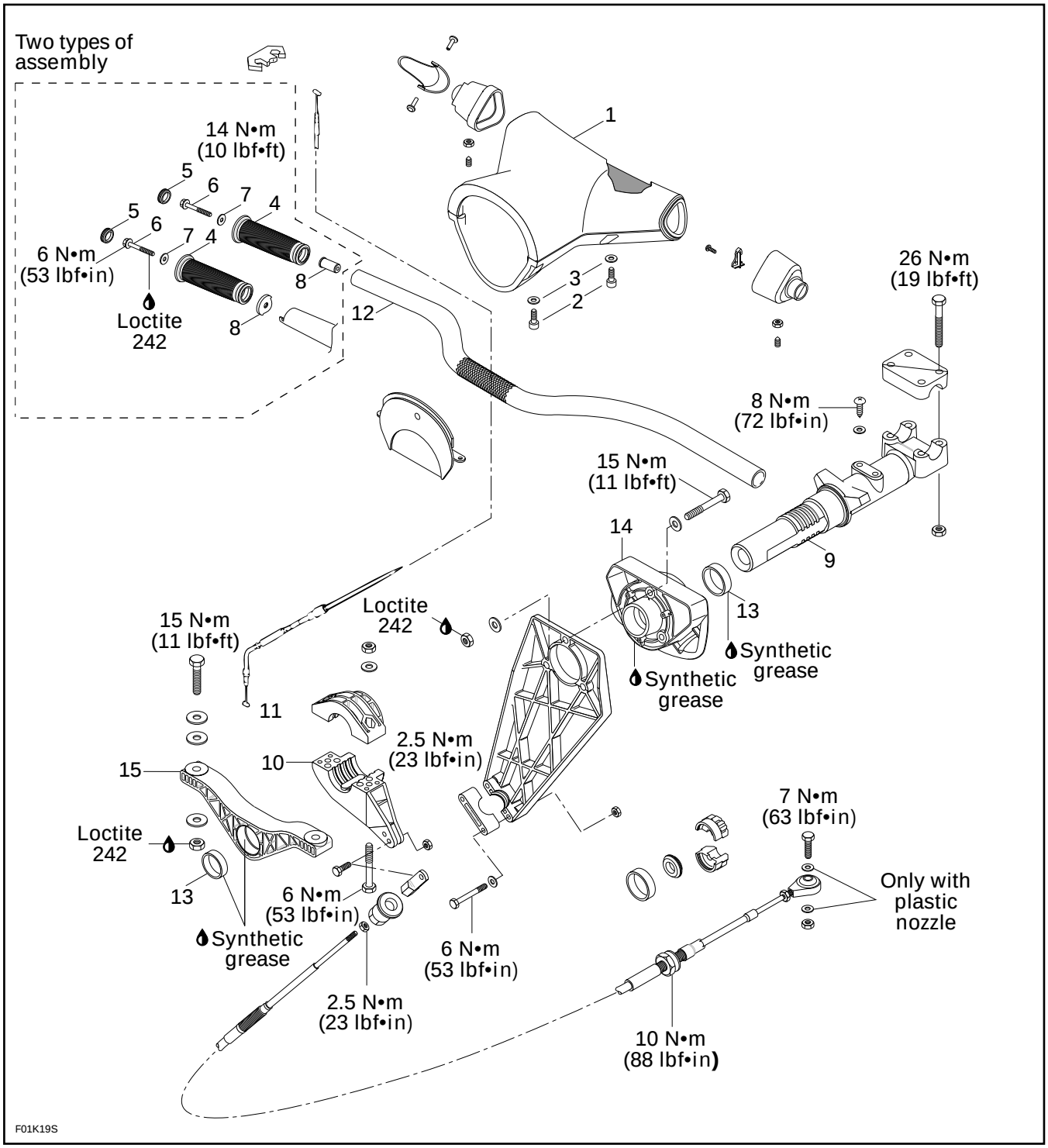
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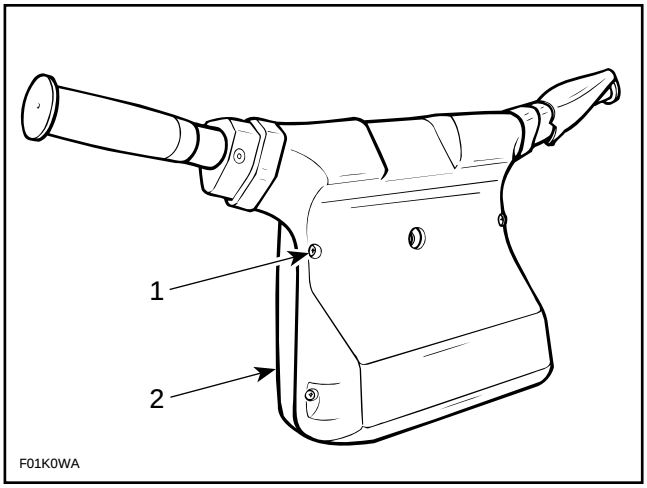


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REMOVAL AND ASSEMBLY

1,2,3, Cover, Screw and Washer

To replace the cover, just remove and reinstall 4 screws and washers.



1. *Screw*
2. *Cover*

4,5,6,7,8, Grip, Cap, Bolt, Washer and Grip Insert

To remove grip, just pull out cap from grip end and remove bolt.

Pull out grip.

There is two possible assemblies for the grip insert.

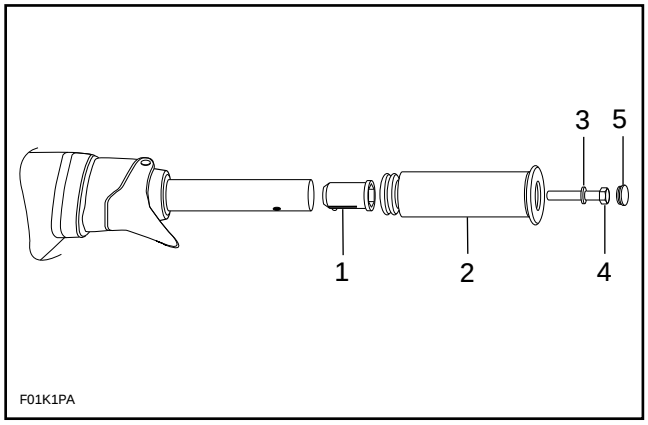
TYPE A

To verify grip insert for damage, remove it from handlebar.

When installing the grip insert, ensure that its notch is properly aligned with the hole beneath the handlebar.

Install grip on handlebar matching it to the hex form on the grip insert.

Install flat washer and bolt, torque bolt to 14 N•m (10 lbf•ft).

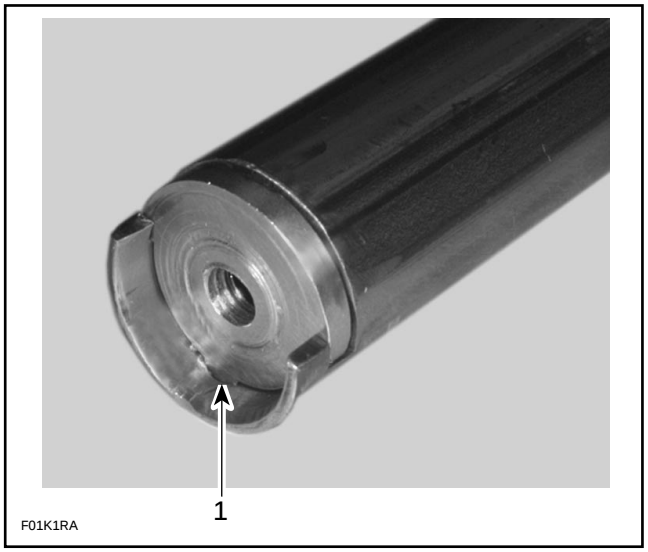


1. *Grip insert*
2. *Grip*
3. *Flat washer*
4. *Torque bolt to 14 N•m (10 lbf•ft)*
5. *Cap*

CAUTION : Ensure to install flat washer otherwise bolt will damage grip end.

TYPE B

When installing the grip insert, ensure that its notch is properly inserted in the hole beneath the handlebar.



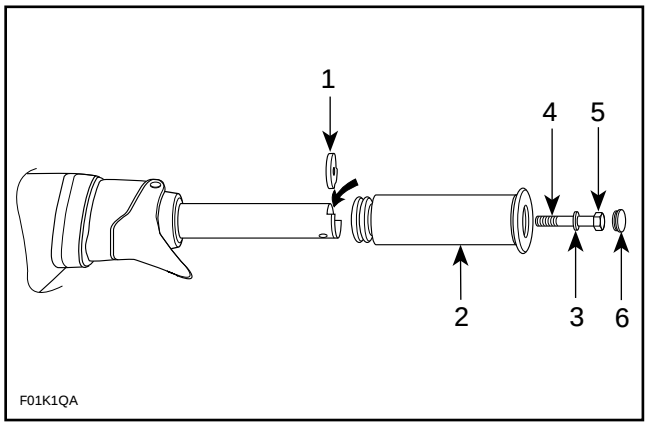
1. *Notch inserted in handlebar hole*

Install grip on handlebar matching it to the U form on the handlebar.

Apply Loctite 242 (blue) on bolt threads.

Install flat washer and bolt, torque bolt to 6 N•m (53 lbf•in).

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1. *Grip insert*
2. *Grip*
3. *Flat washer*
4. *Loctite 242 (blue)*
5. *Torque bolt to 6 N•m (53 lbf•in)*
6. *Cap*

9,10,11,12, Steering Stem, Arm, Support and Handlebar

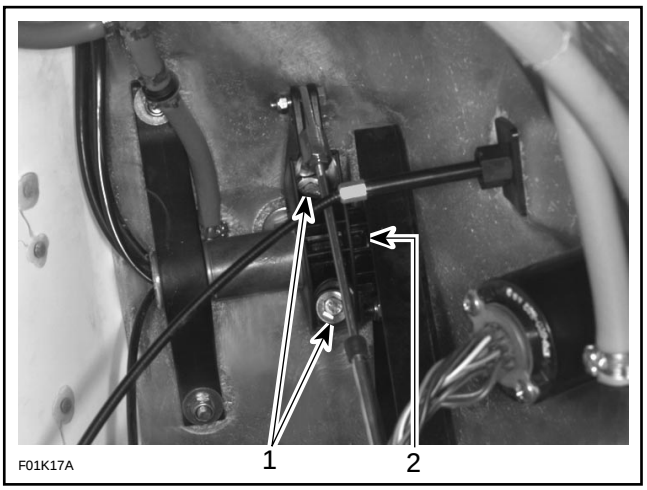
To remove handlebar assemblyþ:

Disconnect wiring harnesses leading out of steering stem.

Disconnect throttle cable at carburetor.

Remove throttle cable from tie-blocks.

Unscrew bolts retaining support to steering stem arm.



1. *Bolts*
2. *Steering stem arm*

Remove support and steering stem arm from steering stem.

NOTE : It is not necessary to remove steering cable from steering stem arm.

Pull out handlebar assembly.

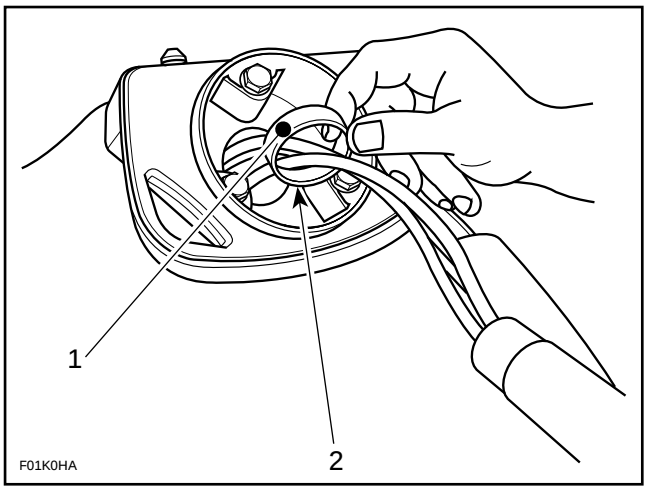
CAUTION : While performing this procedure, take precautions to avoid damaging throttle cable and wiring harnesses.

To install handlebar assembly:

Installation is essentially the reverse of removal procedures. However, pay particular attention to the following.

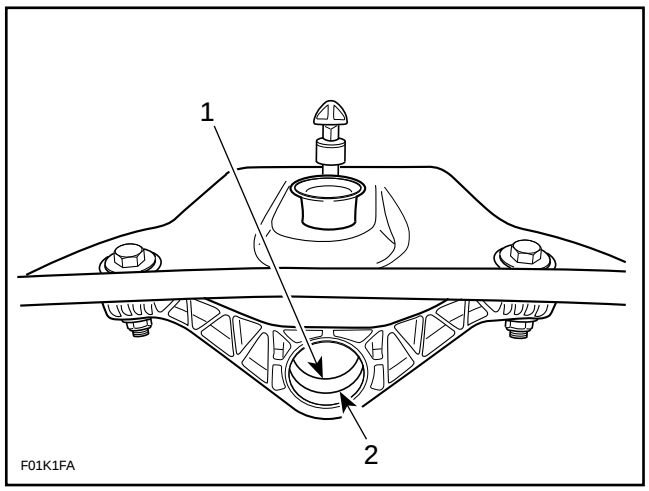
13,14,15, Thrust Ring, Rear and Front Supports

Lubricate with synthetic grease thrust ring of rear and front supports.



REAR SUPPORT SHOWN

1. *Apply synthetic grease*
2. *Thrust ring shown removed for more clarity*



FRONT SUPPORT SHOWN

1. *Apply synthetic grease*
2. *Thrust ring*

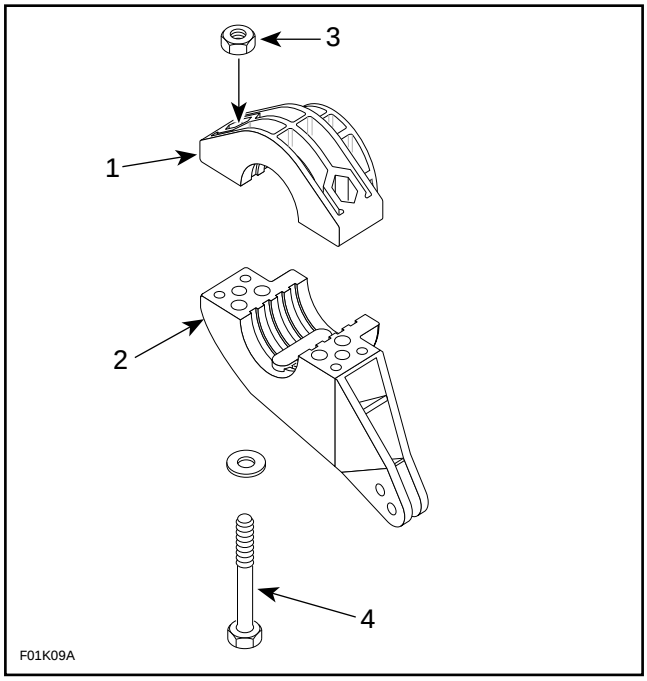
NOTE : Make sure thrust rings are properly installed.

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9,10,11,12, Steering Stem, Arm, Support and Handlebar

Install support to steering stem arm.

NOTE : Insert lock nuts in support. Screw only a few threads of the bolts.



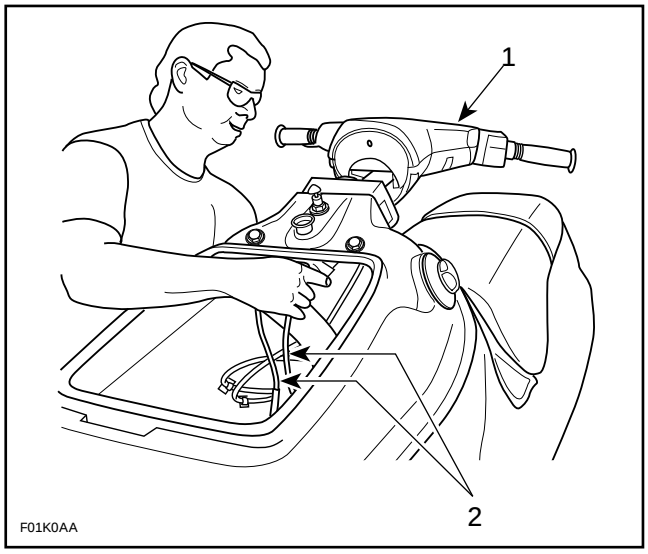
TYPICAL

1. *Support*
2. *Steering stem arm*
3. *Insert lock nuts*
4. *Screw only a few threads of the bolts*

Install handlebar assembly into rear support, taking care at the same time to insert throttle cable and wiring harnesses.

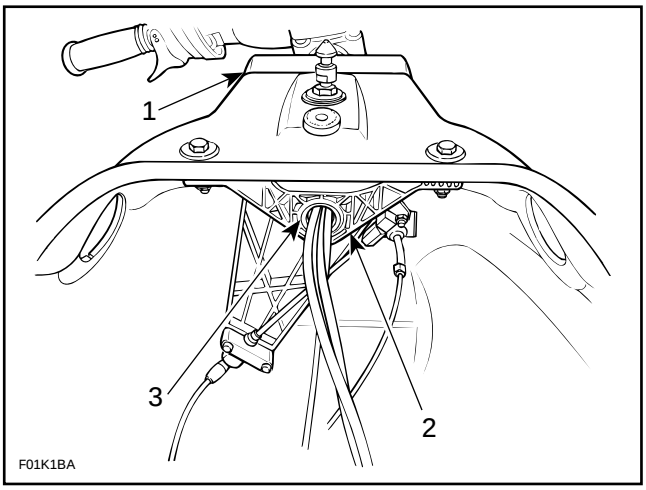
From bilge, route throttle cable and wiring harnesses into steering stem arm and front steering support.

CAUTION : While performing this procedure,take precautions to avoid damaging throttle cable and wiring harnesses.



1. *Install handlebar assembly*
2. *Route throttle cable and wiring harnesses at the same time*

Push handlebar assembly until steering stem is well seated into steering supports.



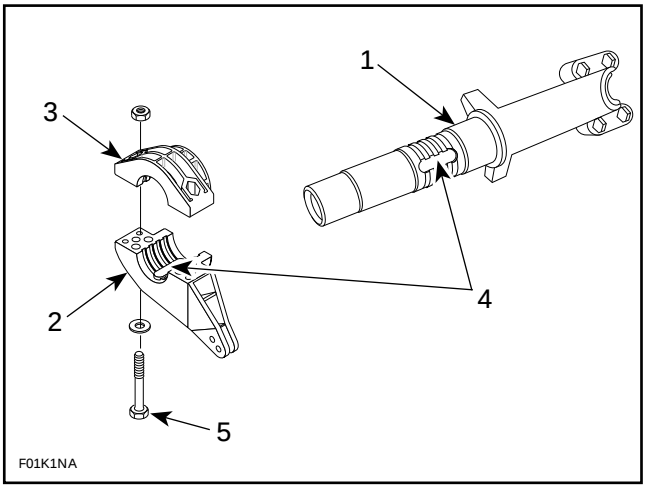
1. *Rear support (steering collar)*
2. *Front support*
3. *Steering stem*

Position steering stem arm and support onto steering stem.

WARNING : Make sure integrated flat key of steering stem arm is properly seated in steering stem keyway. Steering stem arm must be locked in place before torquing the bolts.

Torque bolts of steering stem arm to 6 N•m (53 lbf•in).

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1. *Steering stem*
2. *Steering stem arm*
3. *Support*
4. *Torque to 6þN•m (53þlbf•in)*
5. *Integrated flat key must be seated in keyway and steering stem arm locked in place*

NOTE : Once steering stem arm is properly tightened, look between body and front support to make sure there is no gap between steering stem arm and its support. If there is a gap, components are not properly installed.

Connect wiring harnesses.

Route throttle cable alongside bilge. Insert cable barrel into carburetor throttle lever.

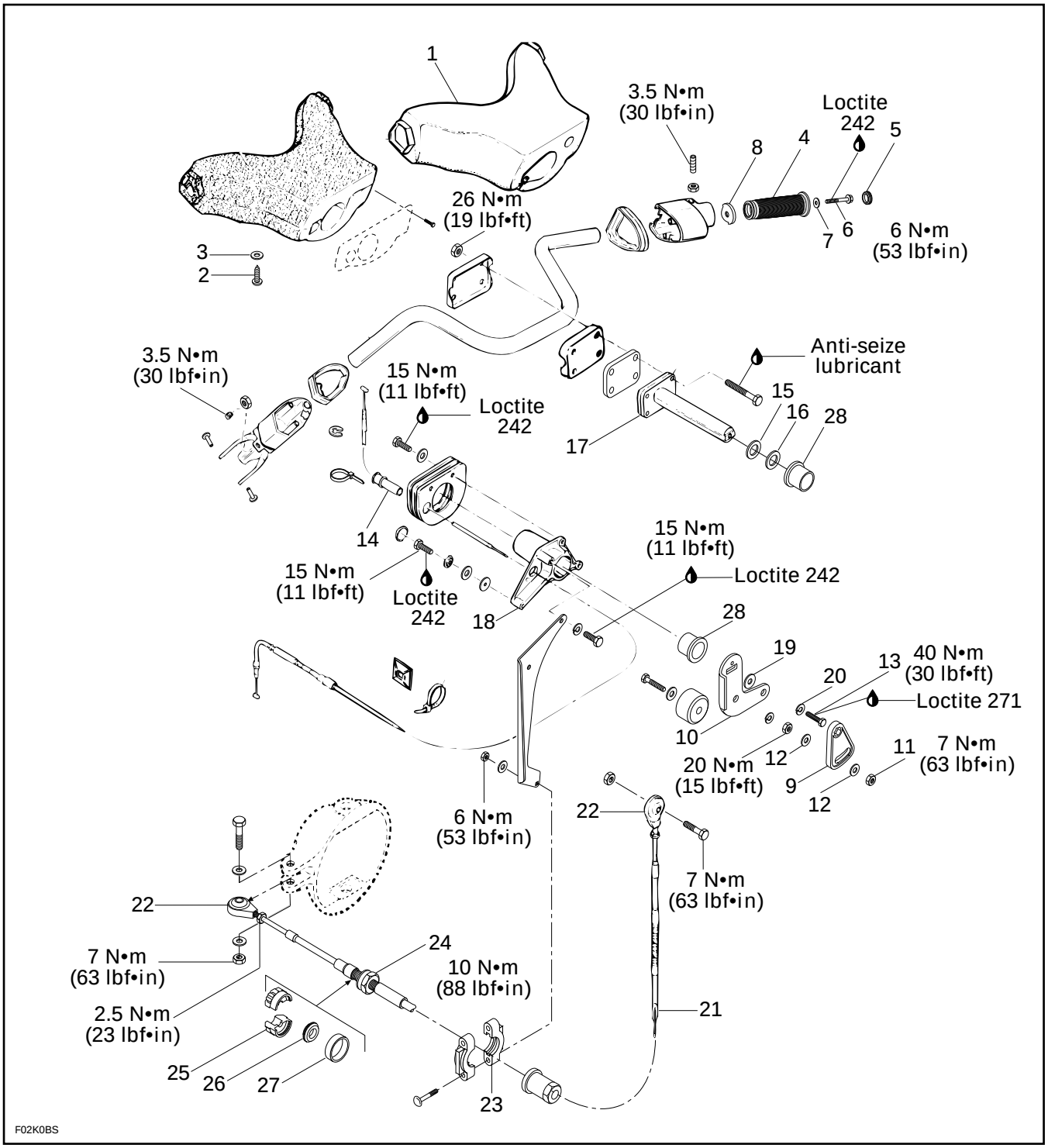
Insert throttle cable alongside choke cable in tie-blocks.

For throttle cable adjustment, refer to FUEL SYSTEM 05-03.

For steering alignment, refer to ALIGNMENT 10-04.

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GTS AND GTI MODELS

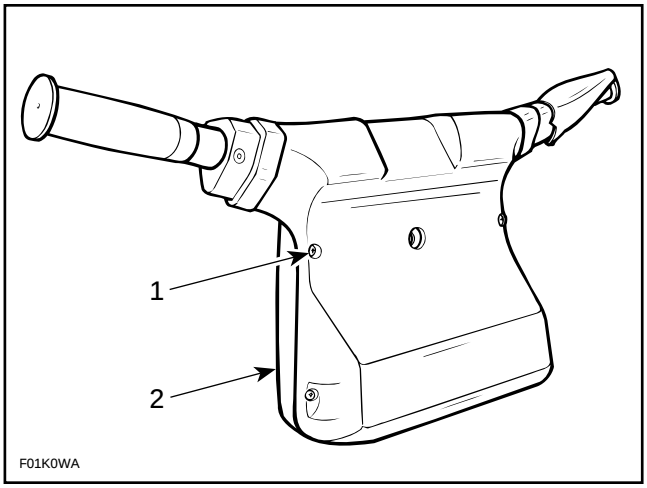


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REMOVAL AND ASSEMBLY

1,2,3, Cover, Screw and Washer

To replace the cover, just remove and reinstall 4 screws and washers.



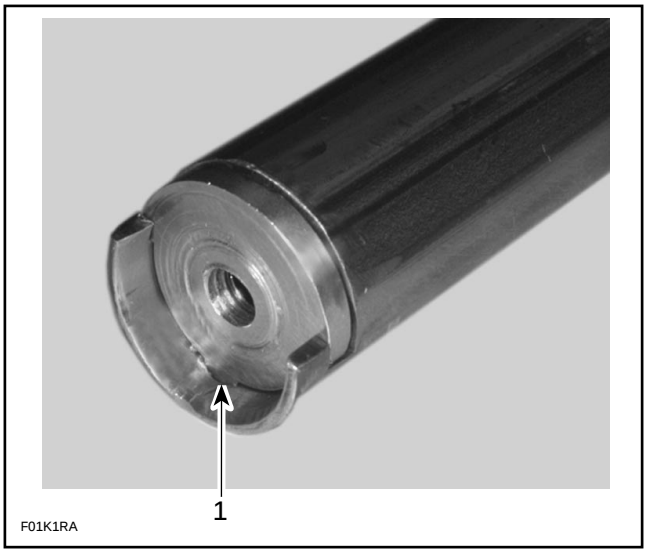
1. *Screw*
2. *Thermoplastic cover*

4,5,6,7,8, Grip, Cap, Screw, Washer and Grip Insert

To remove grip, just pull out cap from grip end and remove screw.

Pull out grip.

When installing the grip insert, ensure that its notch is properly inserted in the hole beneath the handlebar.

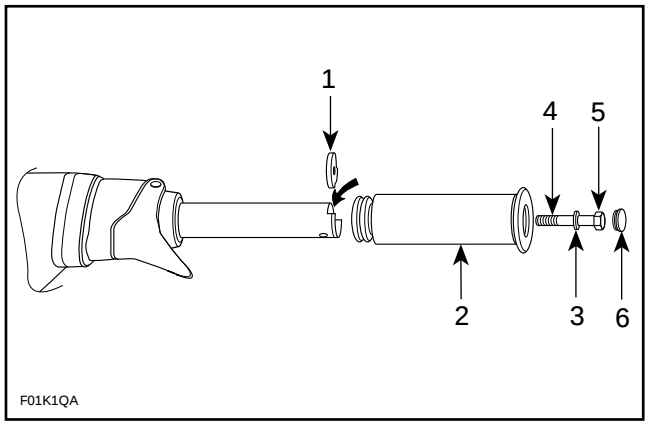


1. *Notch inserted in handlebar hole*

Install grip on handlebar matching it to the U form of the handlebar.

Apply Loctite 242 (blue) on bolt threads.

Install flat washer and bolt; torque to 6 N•m (53 lbf•in).



1. *Grip insert*
2. *Grip*
3. *Flat washer*
4. *Loctite 242 (blue)*
5. *Torque bolt to 6 N•m (53 lbf•in)*
6. *Cap*

Handlebar Assembly

TO REMOVE HANDLEBAR ASSEMBLY :

Disconnect wiring harnesses leading out of dashboard hole.

Disconnect throttle cable at carburetor.

Remove throttle cable from tie-block and clip.

9,10,11,12,13, Locking Plate, Steering Stem Arm, Nut, Washer and Screw

Unscrew nut retaining locking plate, then remove locking plate and washers.

Unscrew screw of steering stem arm.

Pull out handlebar assembly.

NOTE : It is not necessary to disconnect steering cable to remove handlebar assembly.

28, Bushing

Inspect bushings for wear, cracks, scoring, etc. Replace as necessary.

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TO INSTALL HANDLEBAR ASSEMBLY :

14, Grommet

Insert throttle cable through dashboard hole and slide grommet on cable.

Insert grommet in dashboard hole and pull it from inside bilge.

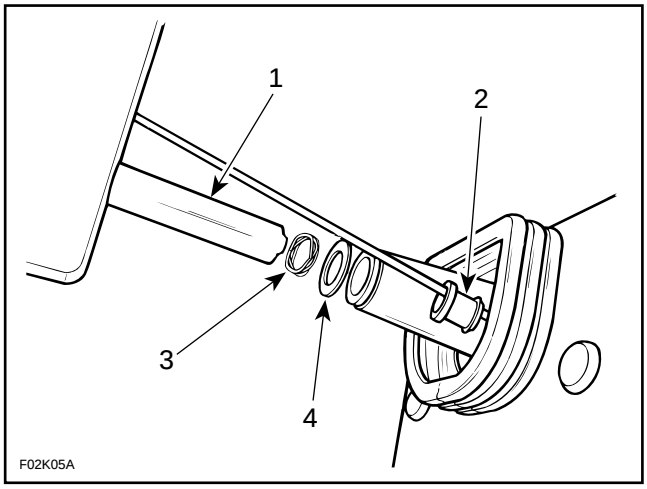
NOTE : To ease installation, apply water on grommet.

Insert wires of monitoring beeper and start / stop button.

15,16,17,18, Spring Washer, Shim, Steering Stem and Support

Insert spring washer and the shim onto steering stem.

Insert steering stem into support.



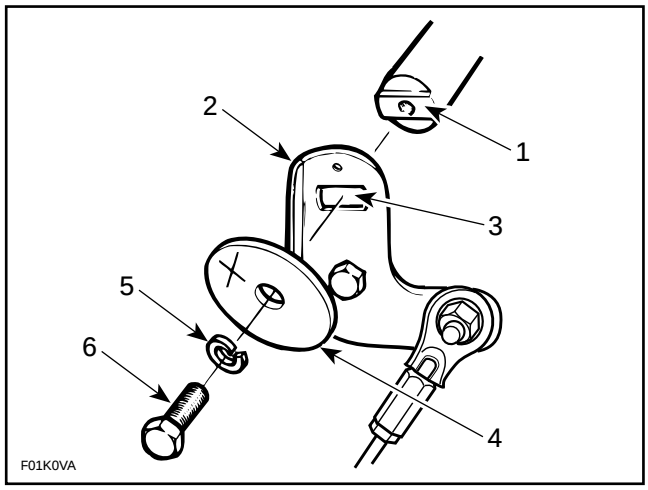
1. *Steering stem*
2. *Grommet*
3. *Shim*
4. *Spring washer*

10,13,19,20, Steering Stem Arm, Screw, Large Washer and Lock Washer

Properly position steering stem arm on steering stem. Make sure to insert stem tenon into arm mortise. Apply Loctite 271 (red) on screw threads, install large flat washer, lock washer and screw. Torque to 40 N•m (30 lbf•ft).

CAUTION : Always install large flat washer with the X stamped side facing the lock washer.

WARNING : The recommended torque and Loctite must be applied on screw. Steering arm mortise must seat properly on steering stem tenon.



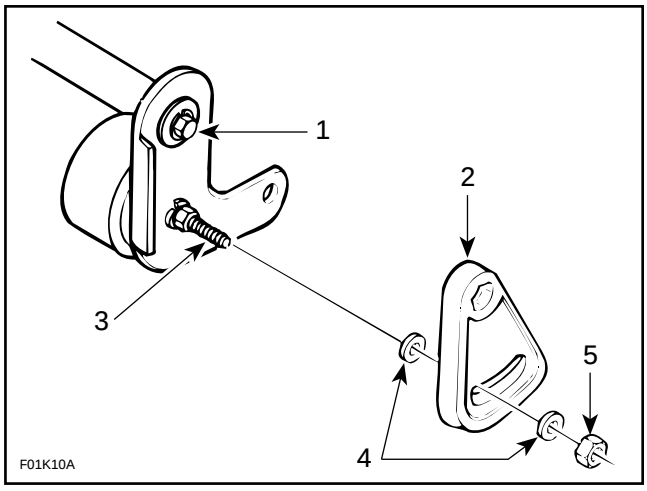
TYPICAL

1. *Steering stem arm*
2. *Steering stem tenon*
3. *Mortise*
4. *Large flat washer with X*
5. *Lock washer*
6. *Screw, apply Loctite 271 and torque to 40 N•m (30 lbf•ft)*

Position 8 mm flat washer on steering stopper screw then install locking plate over steering stem head screw.

NOTE : Ensure locking plate slot is inserted in steering stopper screw.

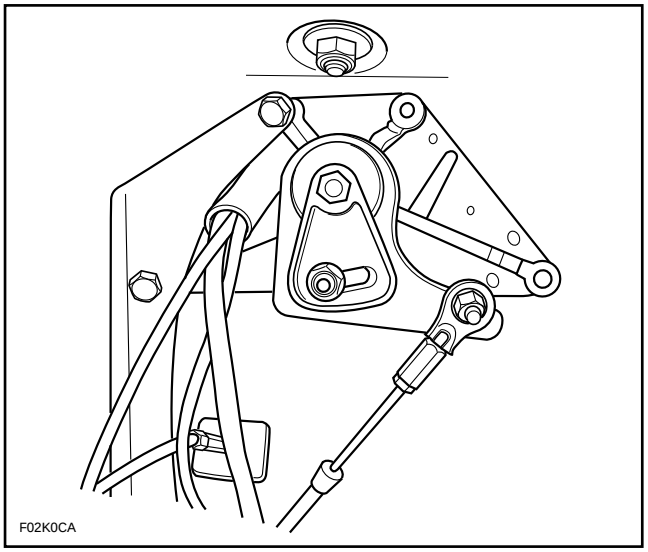
Install 8 mm flat washer and secure locking plate using a jam nut. Torque to 7 N•m (62 lbf•in).



STEERING CABLE NOT SHOWN FOR MORE CLARITY

1. *Steering stem head screw*
2. *Locking plate*
3. *Steering stopper screw*
4. *8 mm flat washers*
5. *Torque nut to 7 N•m (62 lbf•in)*

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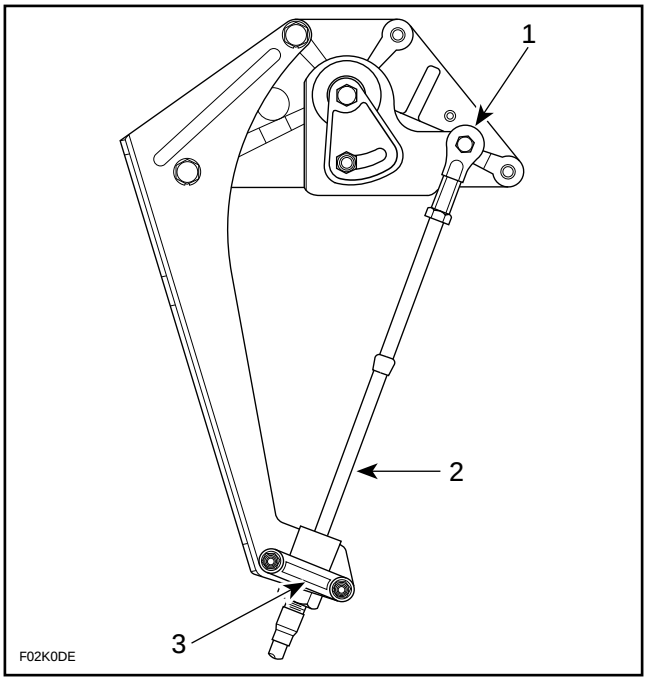
TYPICAL

21,22,23, Steering Cable, Ball Joint and Retaining Block

To replace steering cable, proceed as follows :

Disconnect ball joint at steering stem arm.

Remove nuts and open retaining block.



TYPICAL

1. *Ball joint*
2. *Steering cable*
3. *Retaining block*

Disconnect ball joint at jet pump nozzle ; then, remove ball joint.

24,25,26,27, Nut, Half Ring, Rubber Washer and Retaining Ring

From bilge, unscrew nut retaining steering cable to hull.

Remove half rings, rubber washer and retaining ring.

NOTE : Move selector lever in reverse position to lower reverse gate. It will ease part removal.

Remove steering cable from tie-block and clips.

Pull out steering cable.

Assembly is essentially the reverse of disassembly procedures. However pay particular attention to the following.

22, Ball Joint

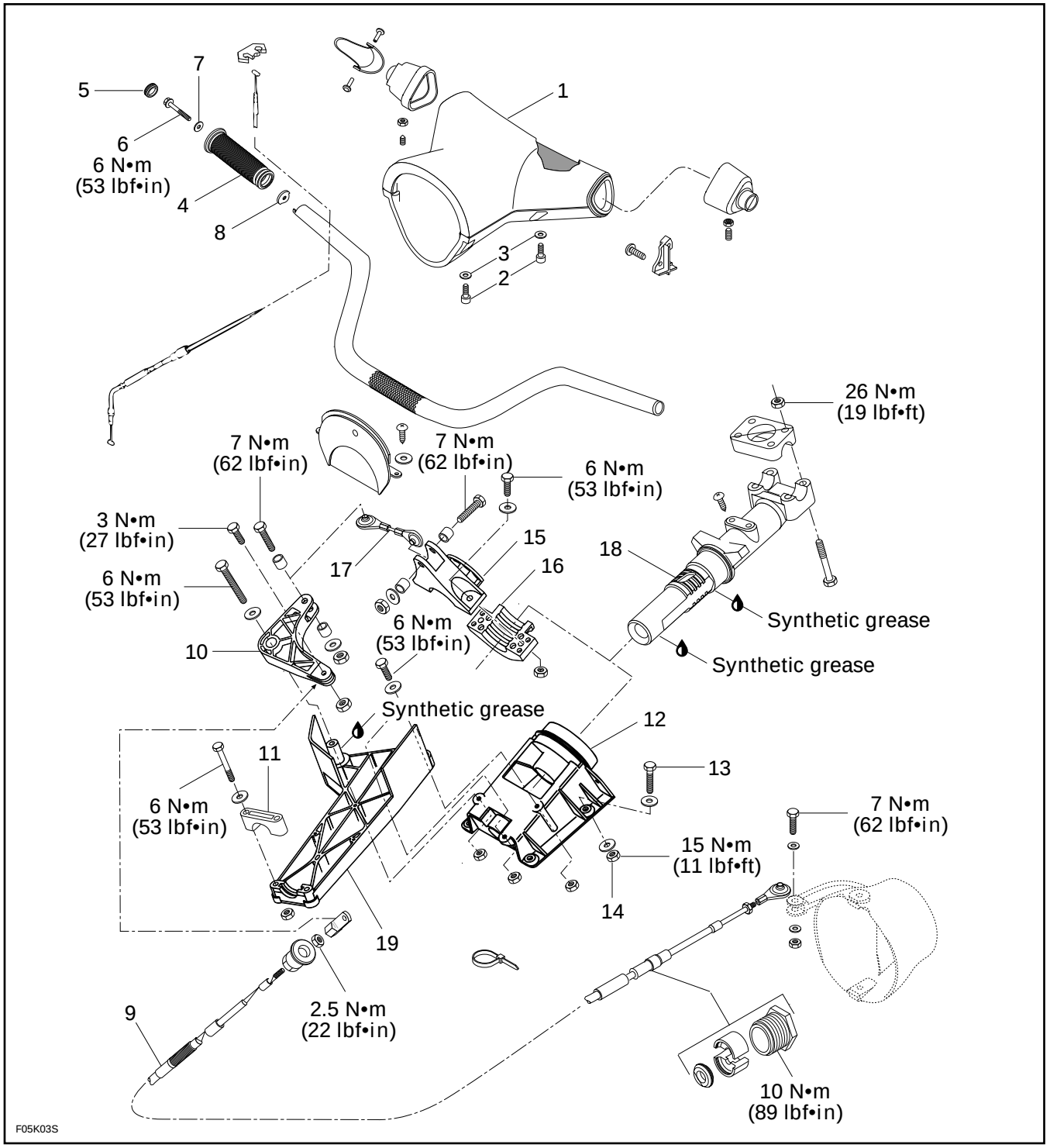
Inspect and reuse ball joints only if they are in good condition.

Steering Alignment

For steering alignment procedure, refer to STEERING SYSTEM 10-04.

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HX MODEL

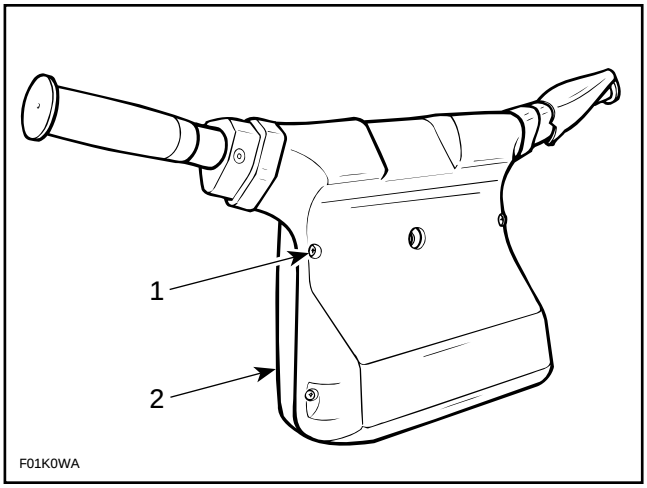


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REMOVAL

1,2,3, Cover, Screw and Washer

To remove the cover, just remove 4 screws and washers.



1. *Screw*
2. *Thermoplastic cover*

4,5,6,7,8, Grip, Cap, Bolt, Washer and Grip Insert

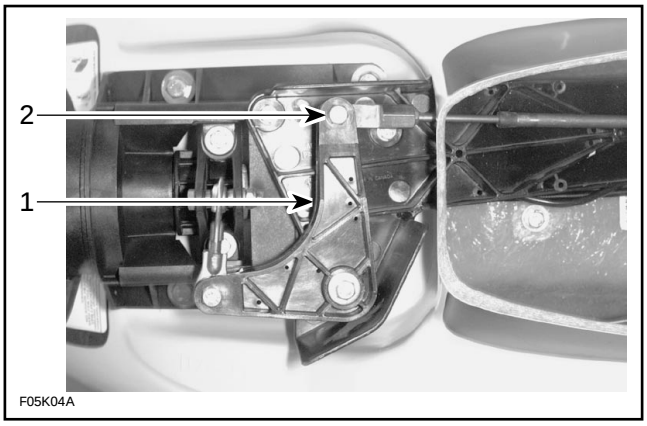
To remove grip, pull out cap from grip end and remove bolt.

Pull out grip.

9,10, Steering Cable and Lever

Remove the hood cover by loosening the 4 plastic Phillips screws. They may need to be replaced after one use.

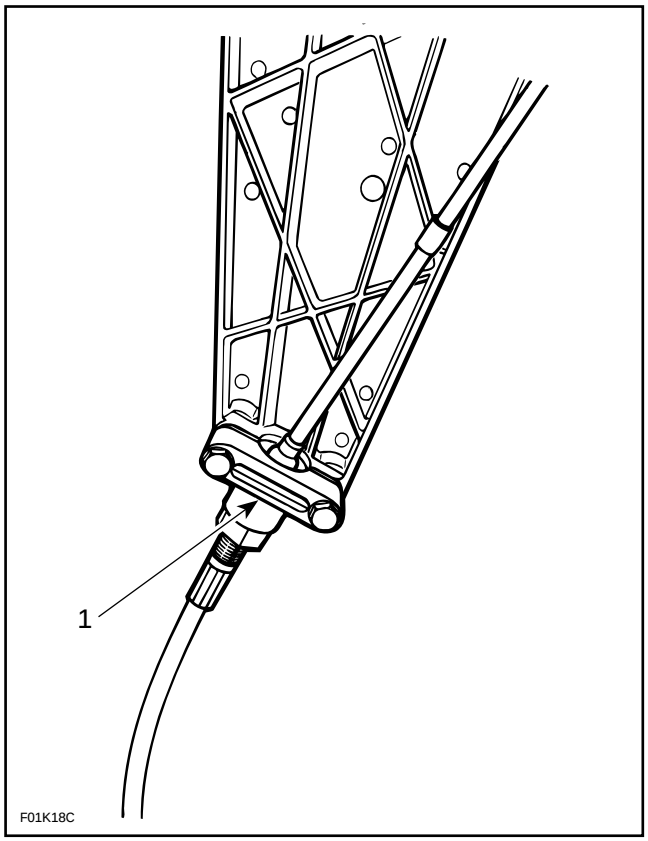
Disconnect steering cable from lever of steering stem arm.



1. *Lever*
2. *Disconnect cable*

11, Retaining Block

Remove retaining block of cable support.



1. *Retaining block*

Miscellaneous

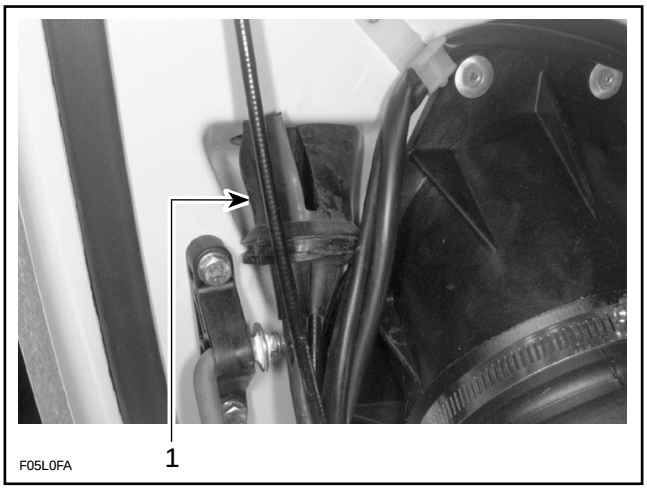
Disconnect wires of monitoring beeper and start / stop switch.

Open hood.

Disconnect throttle cable from carburetor linkage.

Pull out boot from hood and remove throttle cable from boot.

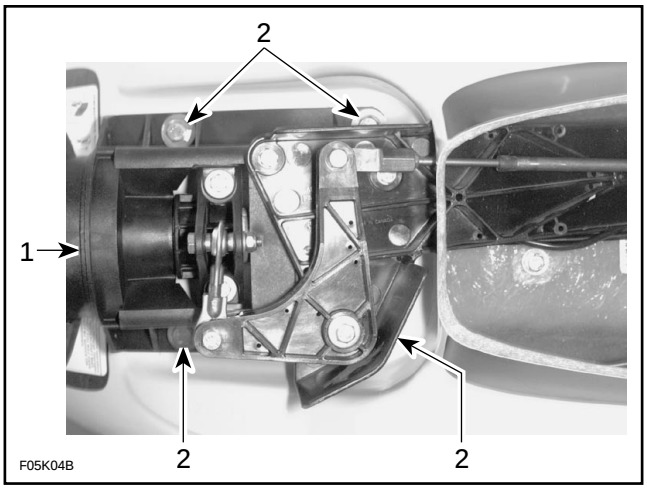
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1. Boot

12,13,14, Steering Support, Bolts and Nuts

Loosen bolts and nuts of steering support.



1. Steering support
2. Bolts

Remove steering system assembly.

DISASSEMBLY

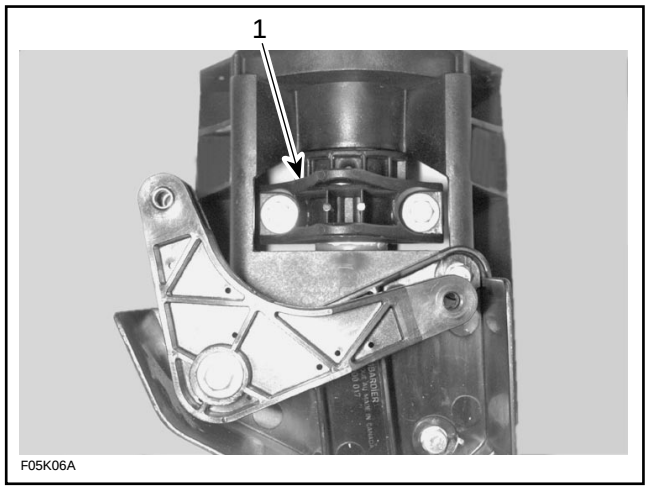
10,15,16,17, Lever, Steering Stem Arm, Support and Ball Joint

Disconnect ball joints from steering stem arm and lever.

Slide the steering stem arm and support rearward and rotate it 90°.

Remove the 2 M6 x 25 screws and nuts.

Remove the steering stem arm.



1. Steering stem arm

12,18,19, Steering Support, Steering Stem and Cable Support

Pull out steering stem from steering support.

Remove lever from cable support.

STEERING CABLE REMOVAL

Disconnect steering cable from lever of steering stem arm.

Remove retaining block of cable support.

Pull out boot of steering cable and throttle cable from hood.

Disconnect ball joint of steering cable from jet pump nozzle.

Remove ball joint, boot, nut, half rings and O-ring from steering cable.

Remove cable from watercraft.

ASSEMBLY AND INSTALLATION

Assembly and installation are essentially the reverse of removal and disassembly procedures. However, pay particular attention to the following.

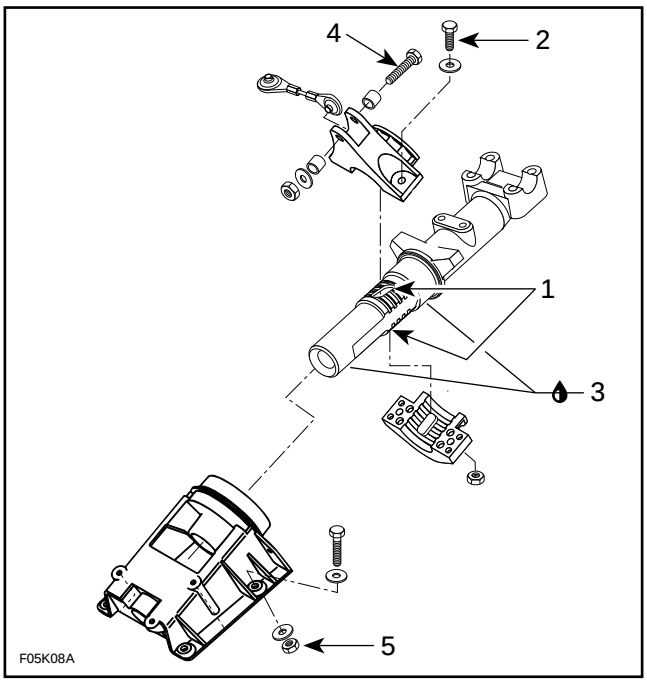
10,12,15,16,18, Lever, Steering Support, Steering Stem Arm, Support and Steering Stem

Prior installing lever, apply synthetic grease to pivot.

Apply synthetic grease in front and rear thrust bearings of steering support.

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◆ WARNING : Make sure integrated flat keys of steering stem arm and support are properly seated in steering stem keyways.



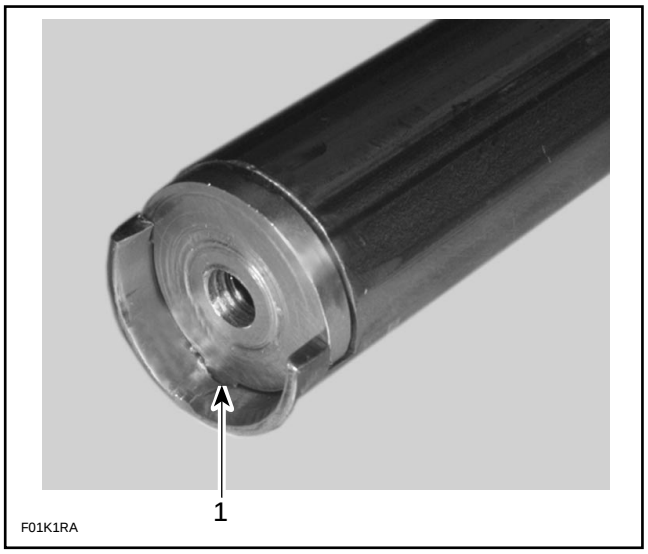
1. *Keyway*
2. *Torque to 6 N•m (53 lbf•in)*
3. *Synthetic grease*
4. *Torque to 7 N•m (62 lbf•in)*
5. *Torque to 15 N•m (11 lbf•ft)*

Apply the proper torque specifications as given in the previous illustration or the main illustration at the beginning of this sub-section.

◆ WARNING : Correct torque must be strictly followed.

4,5,6,7,8, Grip, Cap, Bolt, Flat Washer and Grip Insert

When installing the grip insert, ensure that its notch is properly inserted in the hole beneath the handlebar.

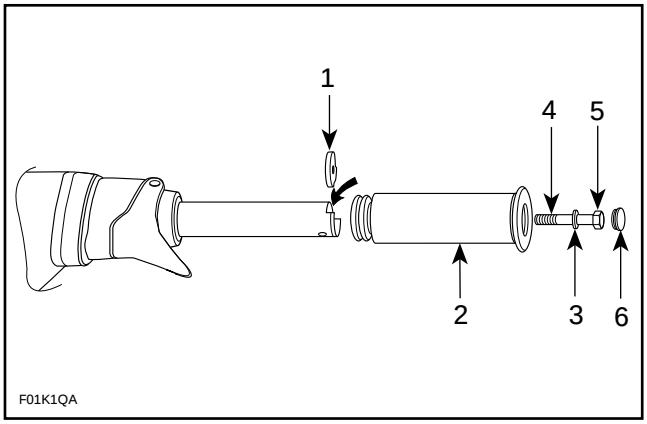


1. *Notch inserted in handlebar hole*

Install grip on handlebar matching it to the U form of the handlebar.

Apply Loctite 242 (blue) on bolt threads.

Install flat washer and bolt ; torque to 6 N•m (53 lbf•in).



1. *Grip insert*
2. *Grip*
3. *Flat washer*
4. *Loctite 242 (blue)*
5. *Torque bolt to 6 N•m (53 lbf•in)*
6. *Cap*

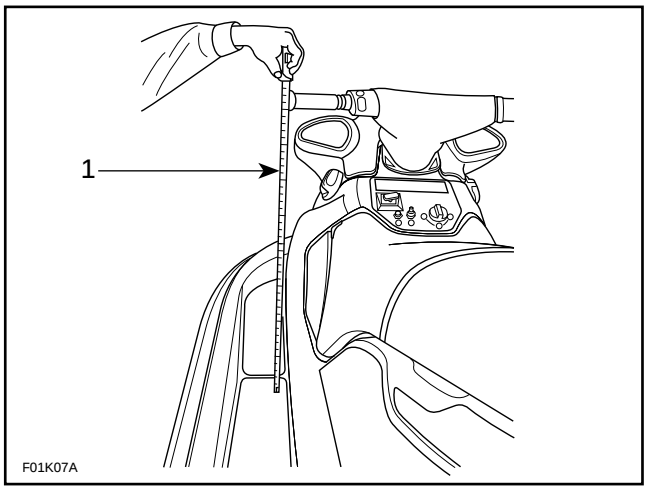
STEERING ALIGNMENT

For steering alignment procedure, refer to STEERING SYSTEM 10-04.

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ALIGNMENT

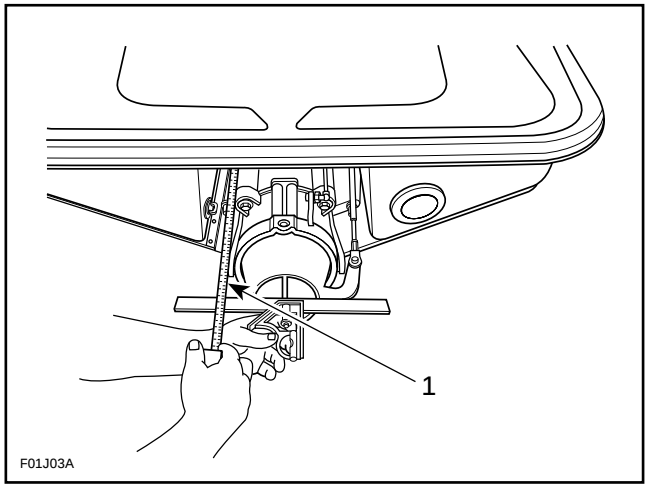
Position handlebar in straight ahead position by measuring each side the distance from handlebar grip end to floorboard.



TYPICAL

1. Measuring handlebar grip end / floorboard distance

Check jet pump nozzle position by placing a straight edge on nozzle outer end. Measure the distance on each side of the straight edge. It must be equalled.



TYPICAL

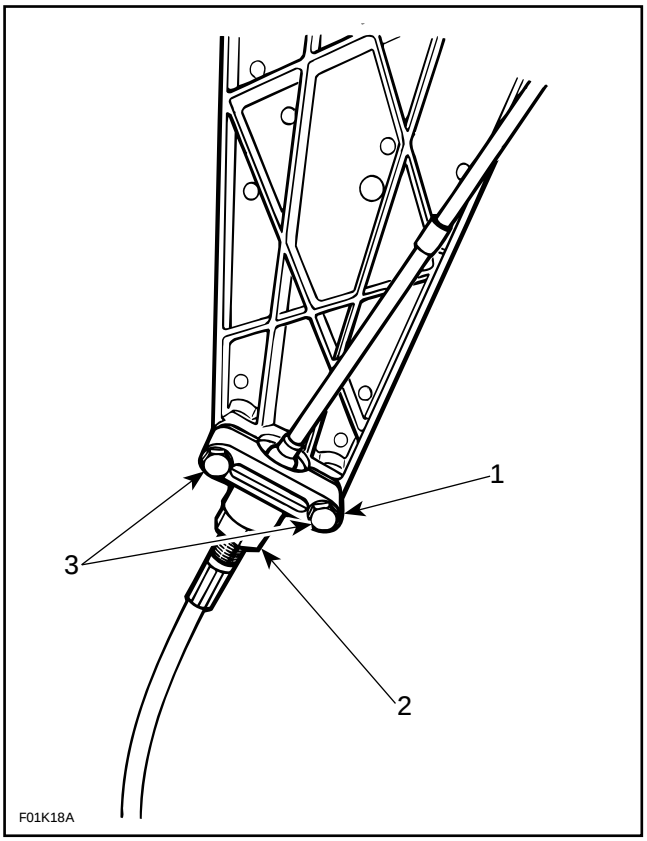
1. Measure the distance on each side of the straight edge

If necessary, steering alignment adjustment should be performed at steering cable support near steering stem.

Slacken retaining block at cable support.

Turn adjustment nut as required.

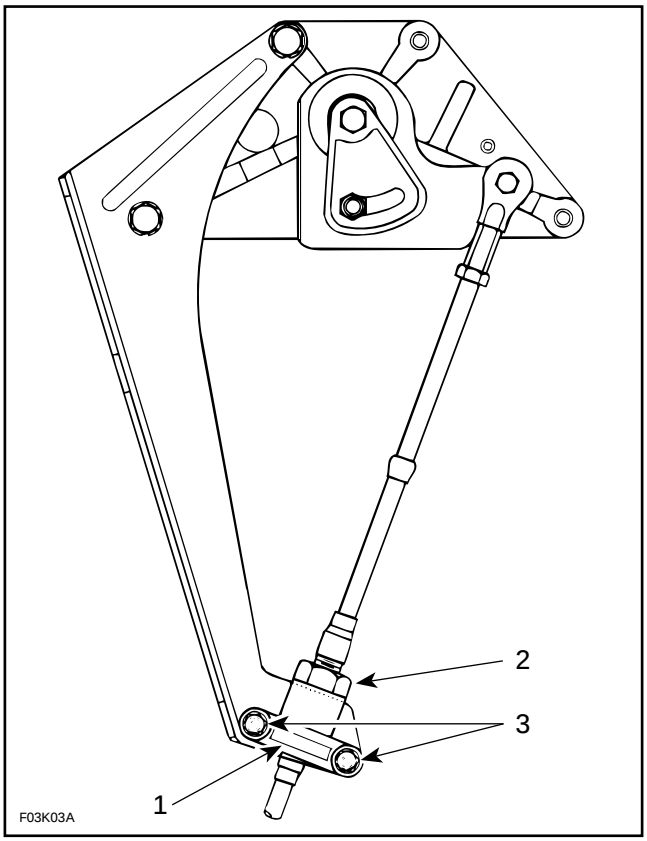
SP / XP Series and HX Models



1. Retaining block
2. Adjustment nut
3. Bolt

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GTS / GTI Models



1. Retaining block
2. Adjustment nut
3. Bolts

All Models

After adjustment, torque retaining block bolts to 6 N•m (53 lbf•in).

▼ CAUTION : Verify when the handlebar is turned completely to the left or right side, that there is no interference with venturi housing.

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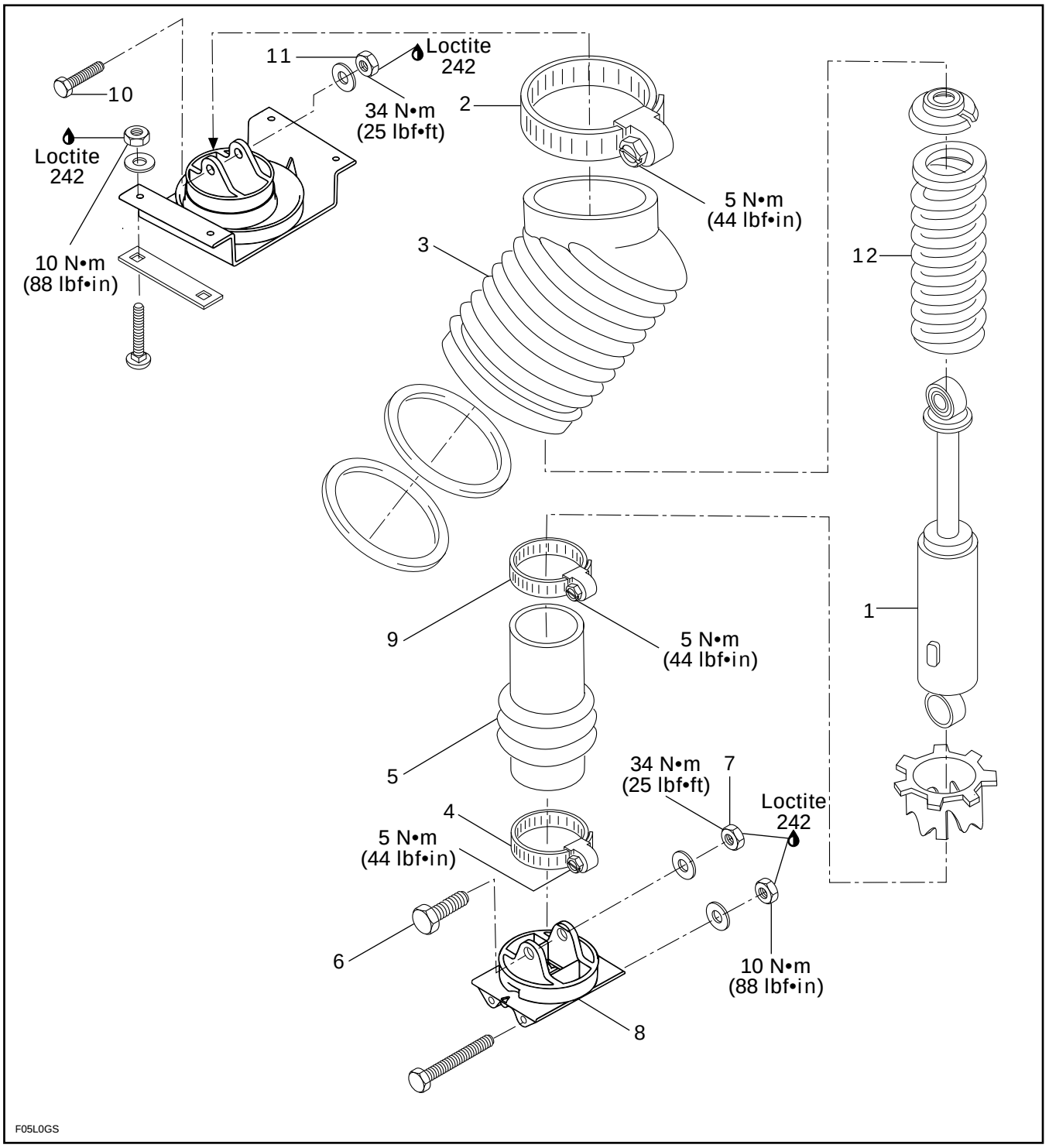
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ASSEMBLY 11-01-3

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DIRECT ACTION SUSPENSION

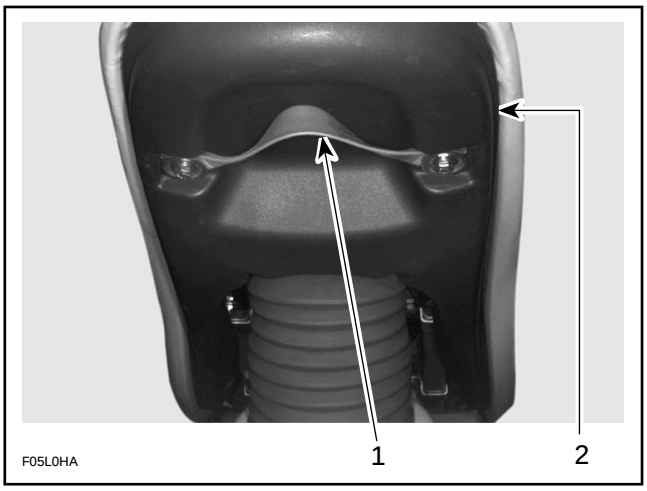
HX Model



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COIL OVER SHOCK REMOVAL

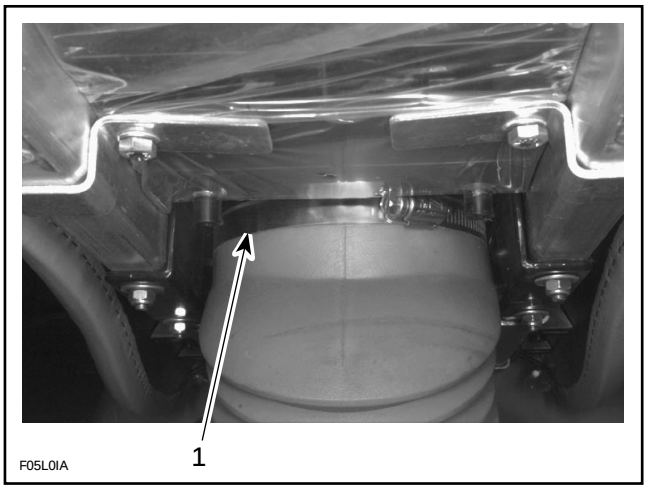
Remove bottom cover of seat with grab handle.



1. *Grab handle*
2. *Cover*

1,2, Outer Boot and Collar

Loosen collar of coil over shock outer boot ; then, pull outer boot downward.

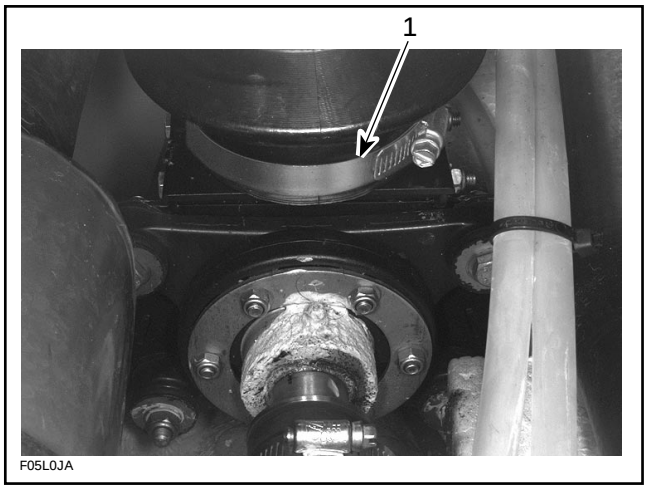


1. *Collar*

3,4, Inner Boot and Collar

Remove rear access panel from body.

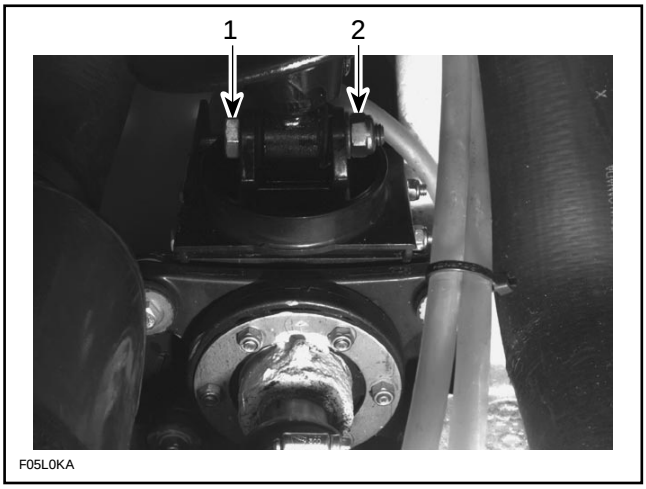
From bilge, loosen lower collar of coil over shock inner boot ; then, push boot upward.



1. *Collar*

5,6 Bolt and Lock Nut

Remove bolt and lock nut from shock absorber lower support.



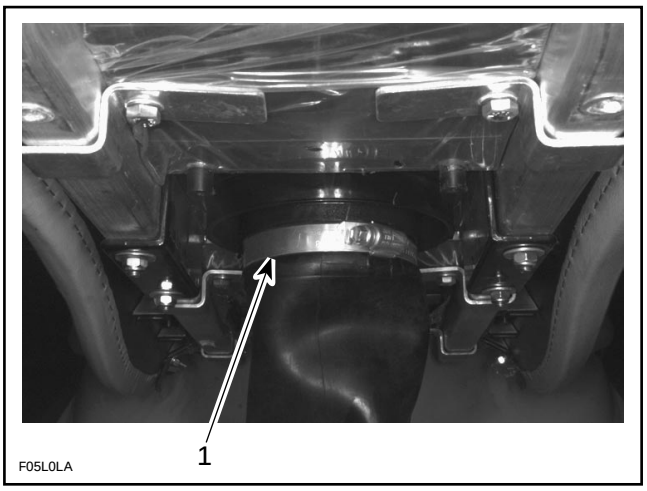
1. *Bolt*
2. *Lock nut*

Tilt seat upward.

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3,7, Inner Boot and Collar

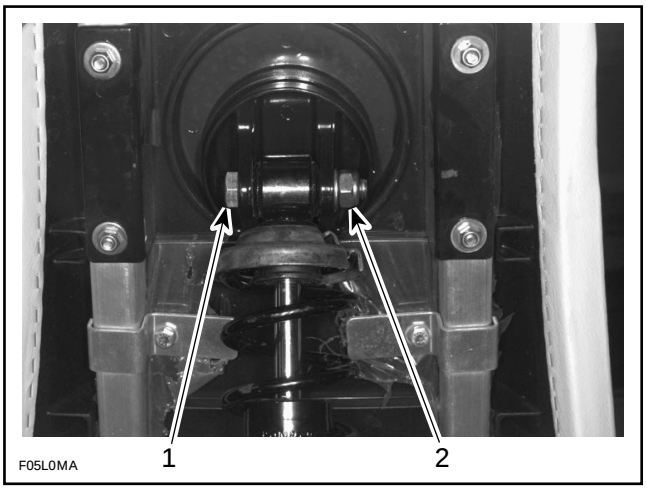
Loosen upper collar of coil over shock inner boot ; then, remove boot.



1. Collar

8,9, Bolt and Lock Nut

Remove bolt and lock nut from shock absorber upper support.



1. Bolt
2. Lock nut

Remove coil over shock.

OUTER BOOT REMOVAL

Using long nose pliers, push out lower retaining ring of outer boot.

Remove outer boot from body.

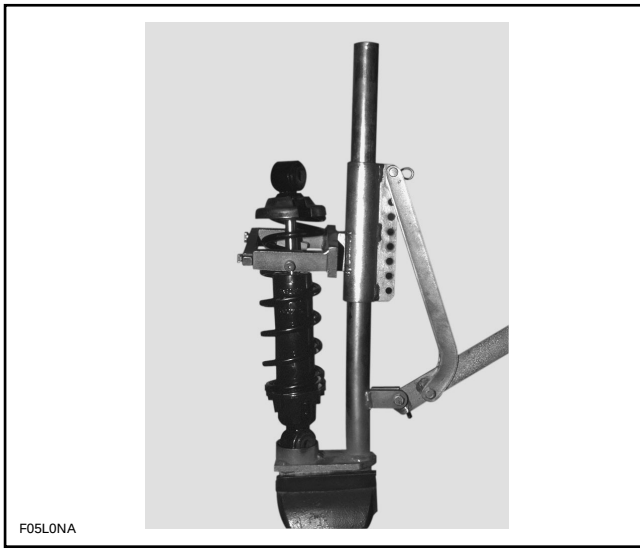
COIL OVER SHOCK DISASSEMBLY

Remove boot.

Install spring compressor tool (P / N 529 027 100) in a vise.

◆ WARNING : Do not attempt to dismantle a spring without using the proper tool.

Install coil over shock in spring compressor tool.



Compress spring and remove cup.

Unload tool and remove spring from shock absorber.

ASSEMBLY

Assembly is essentially the reverse of assembly procedure. Refer to the main illustration at the beginning of this section for torque specifications and service products to be used.

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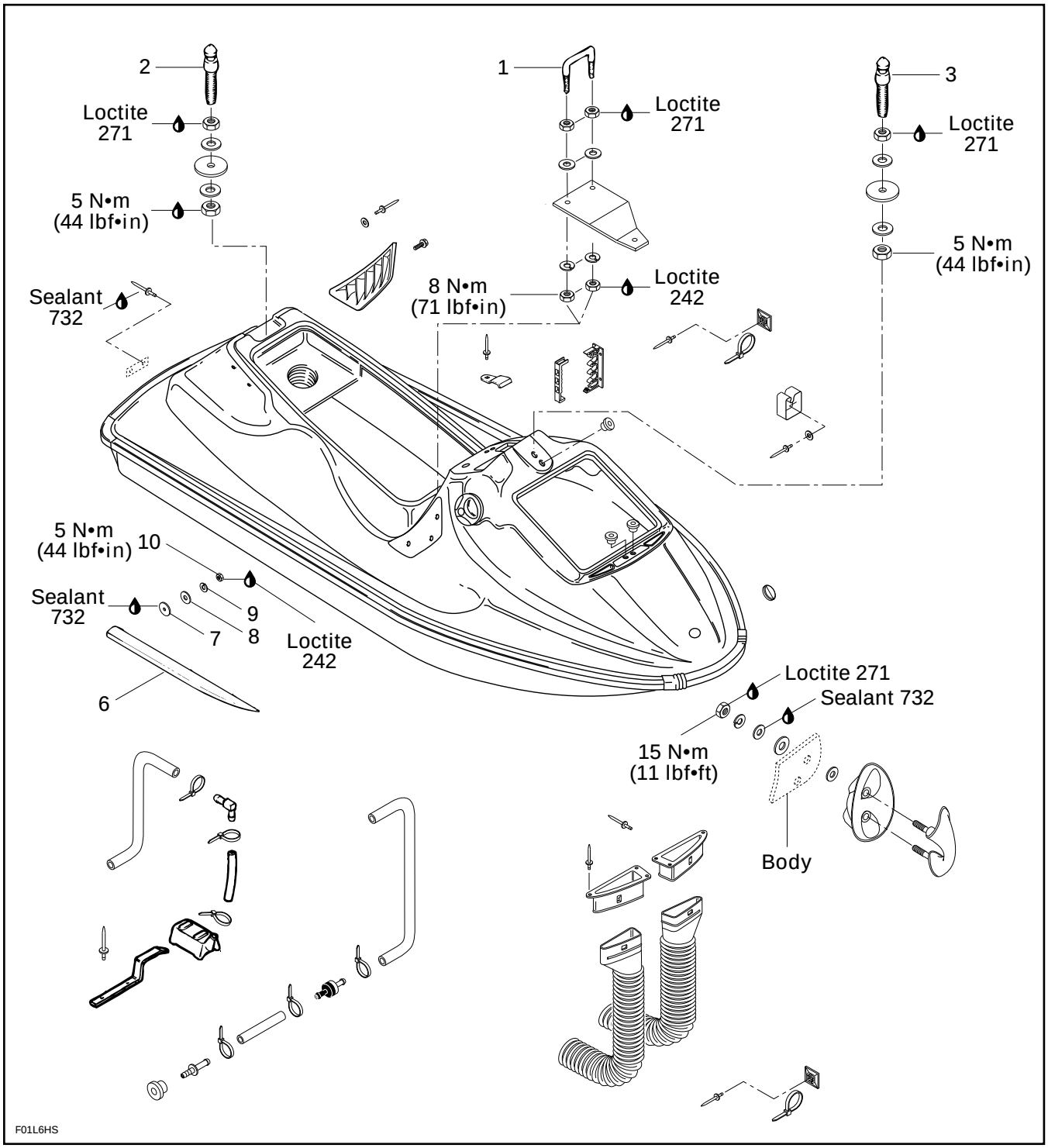
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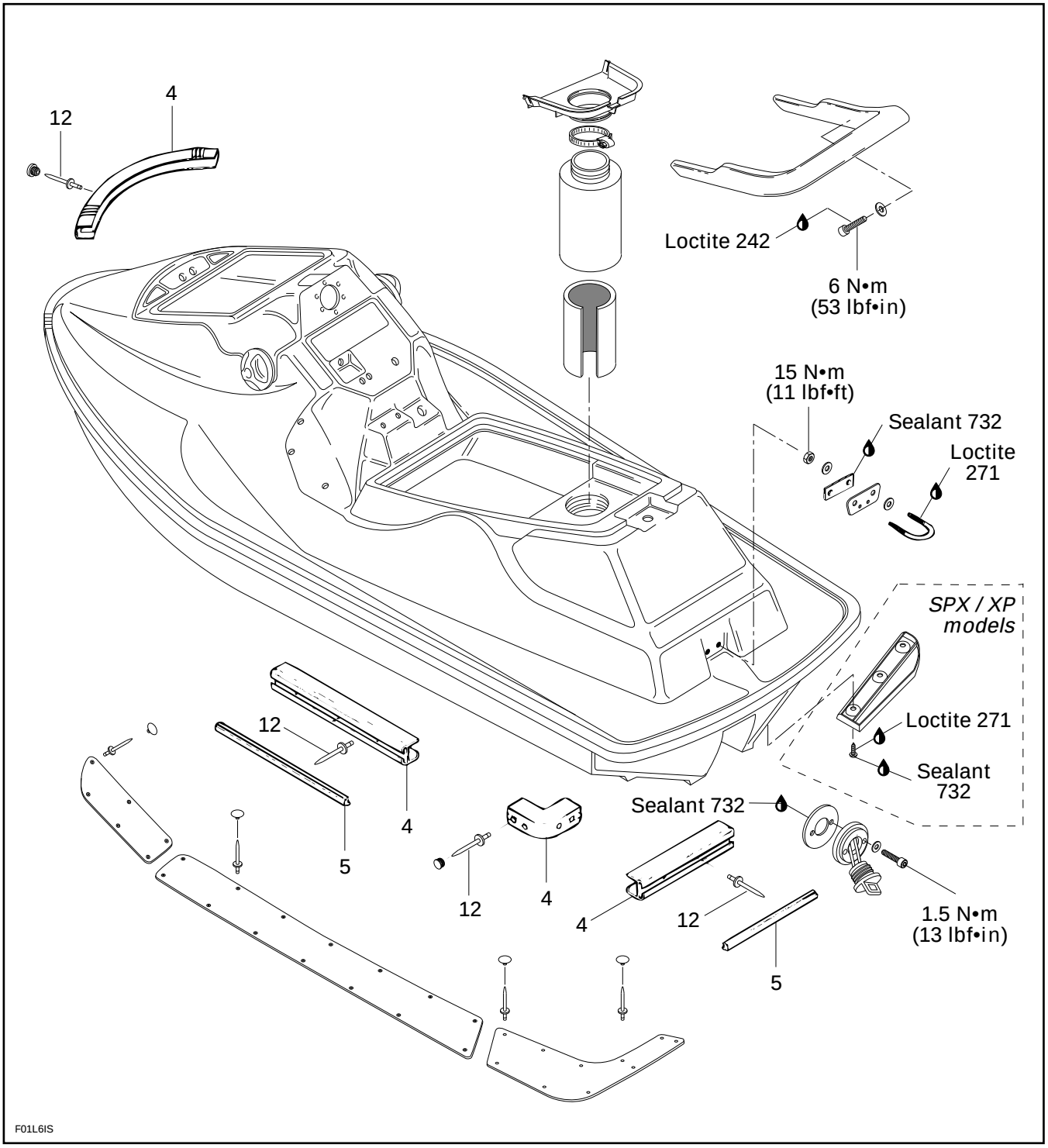
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ADJUSTMENT AND REPAIR

SP / XP Series

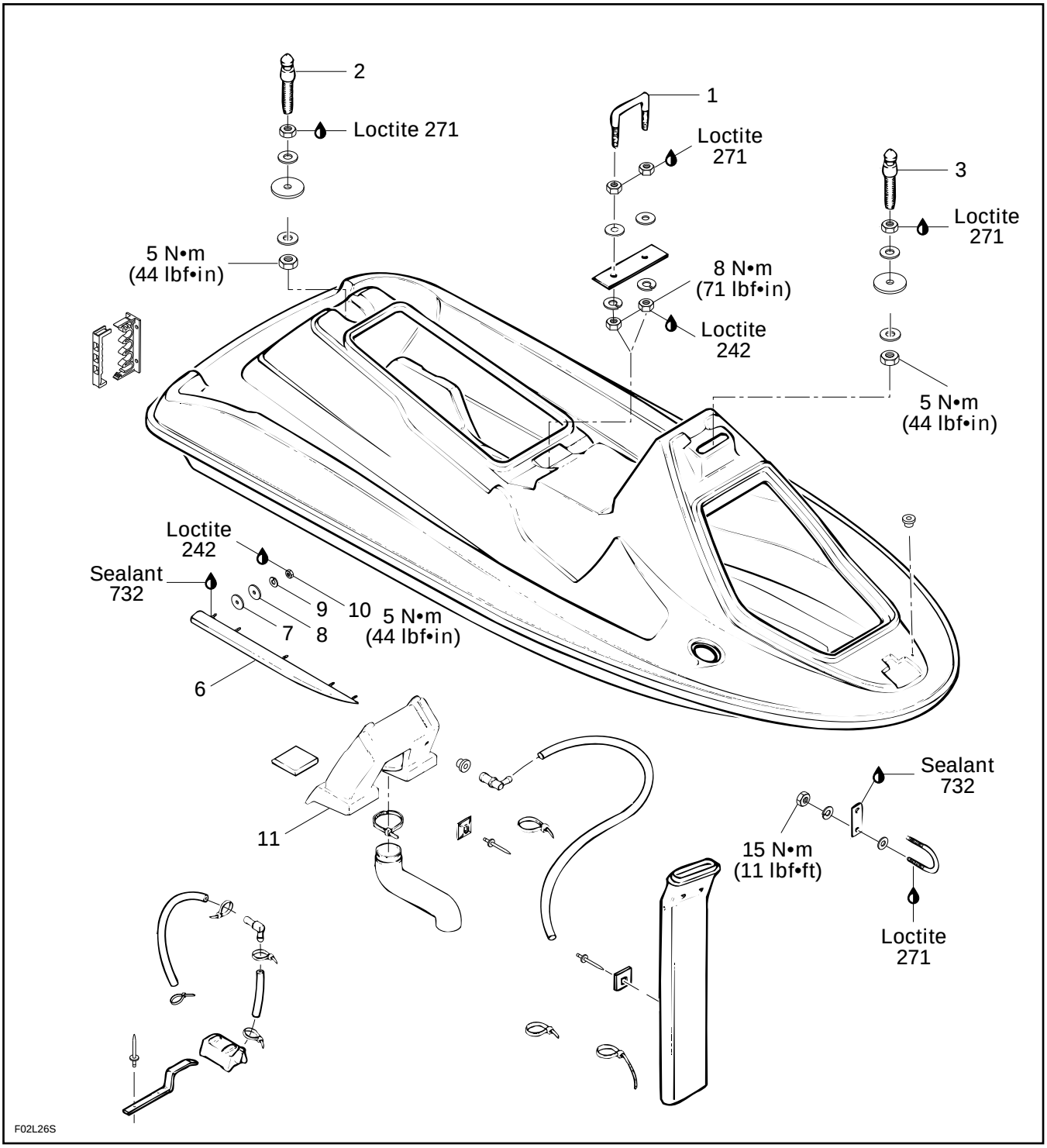


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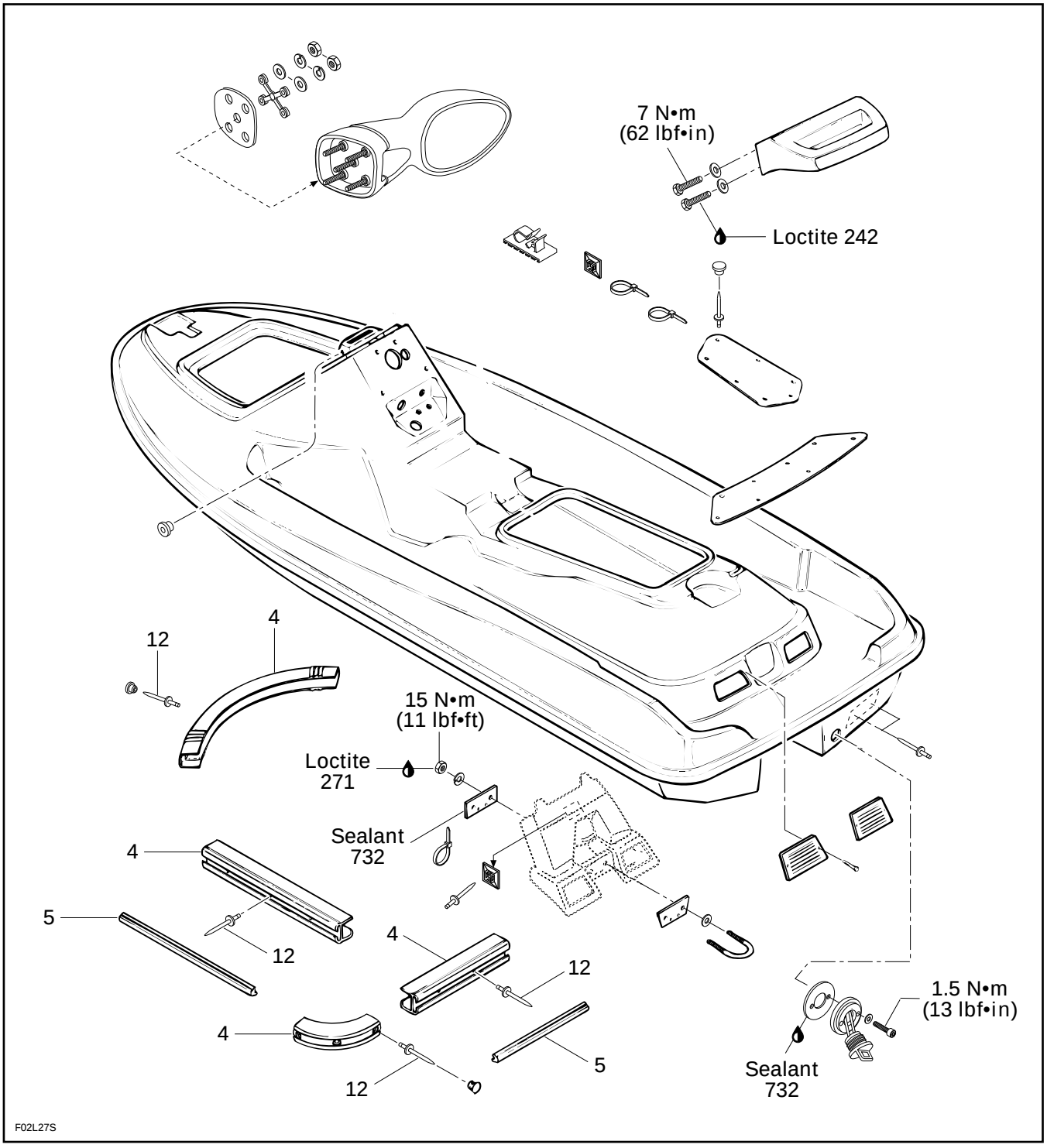


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GTS / GTI Models

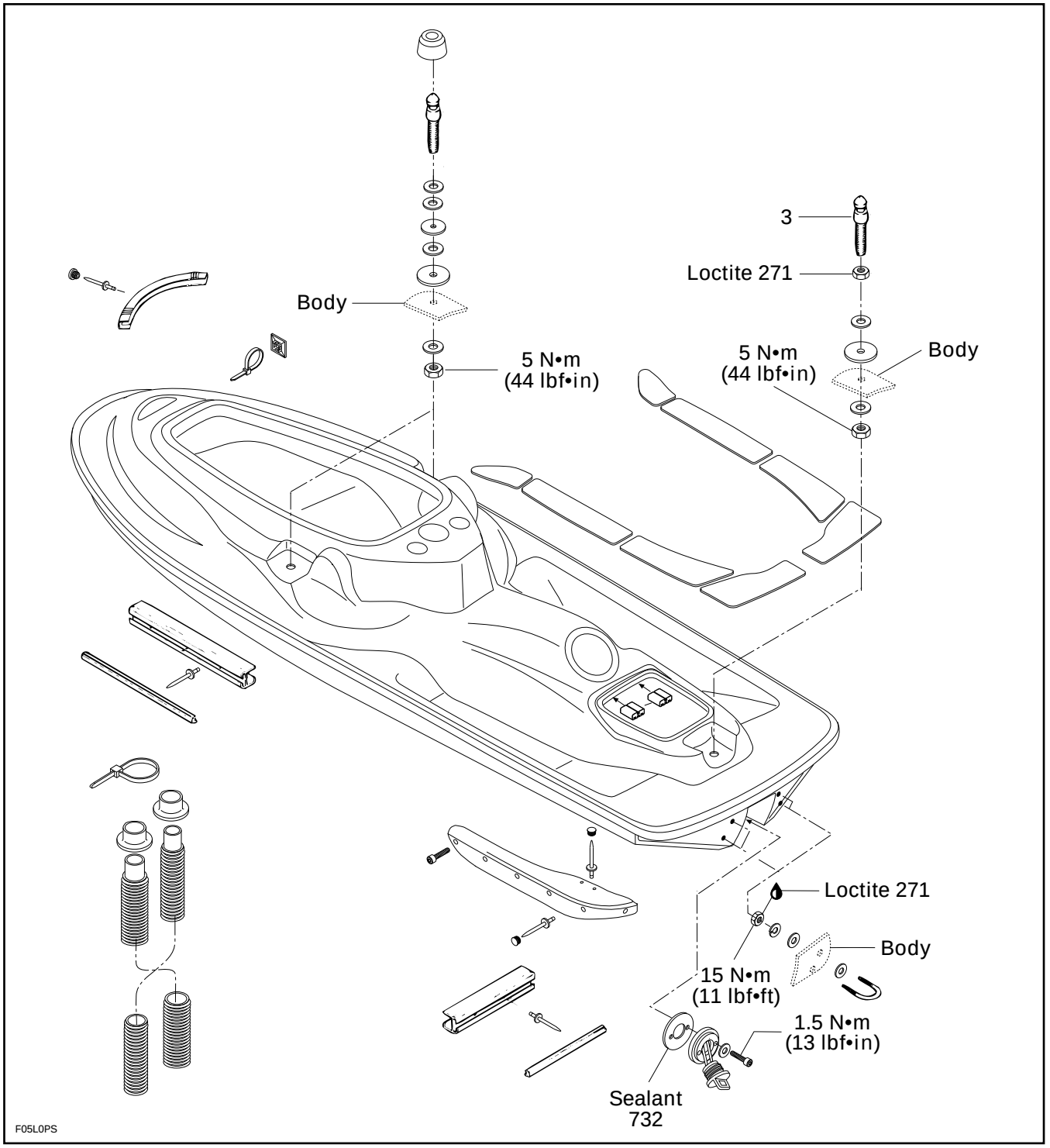


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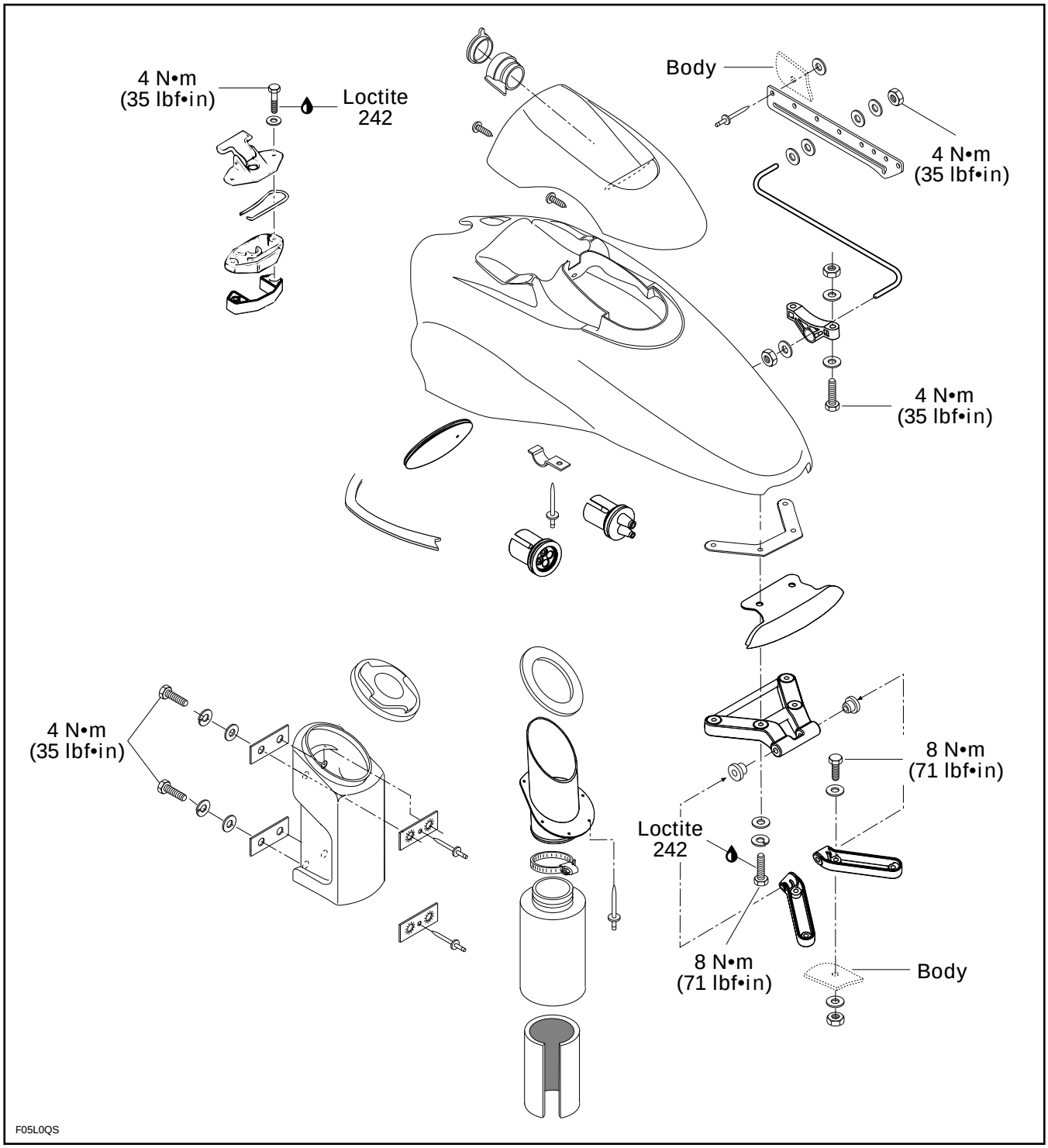


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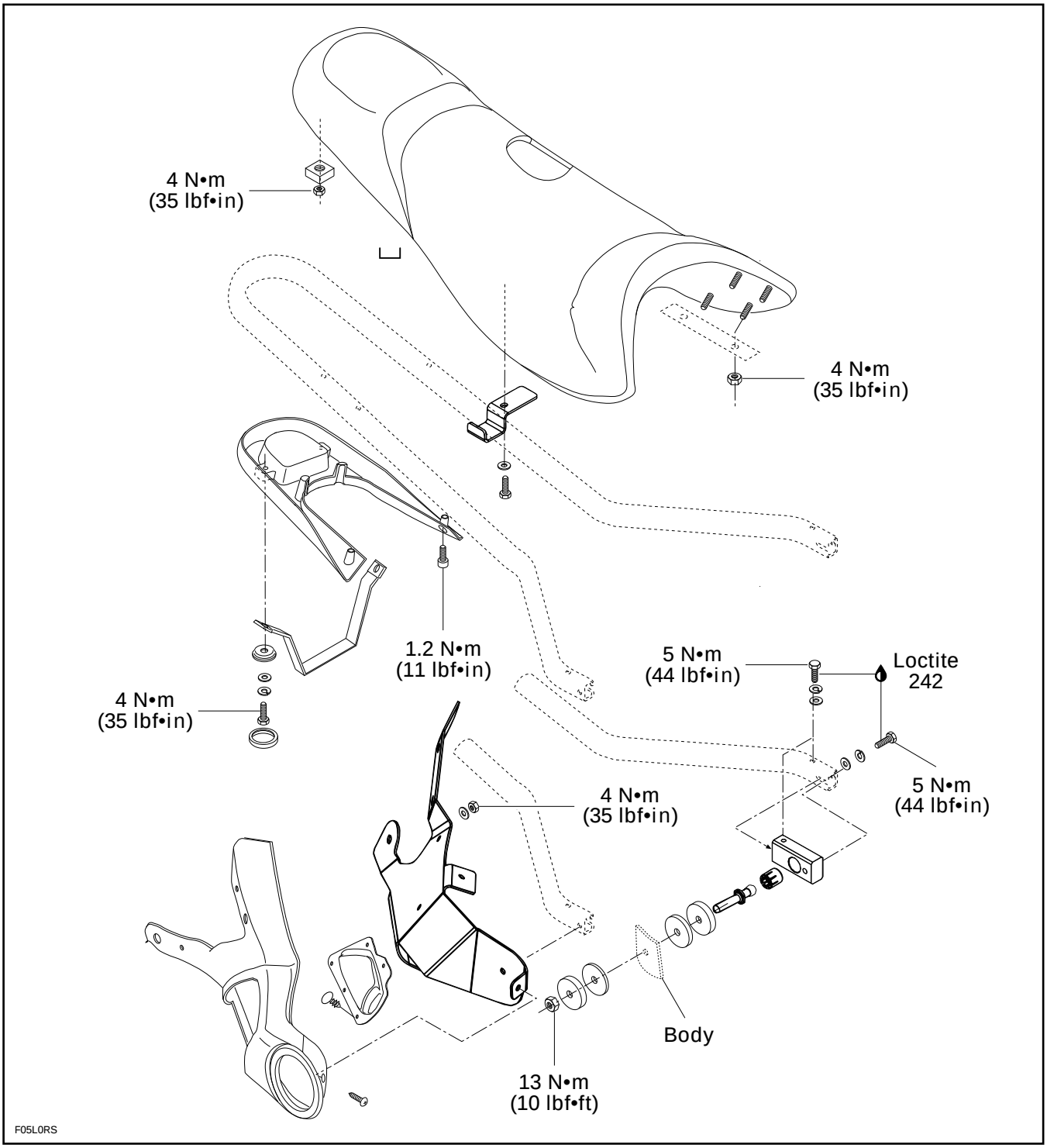
HX Model



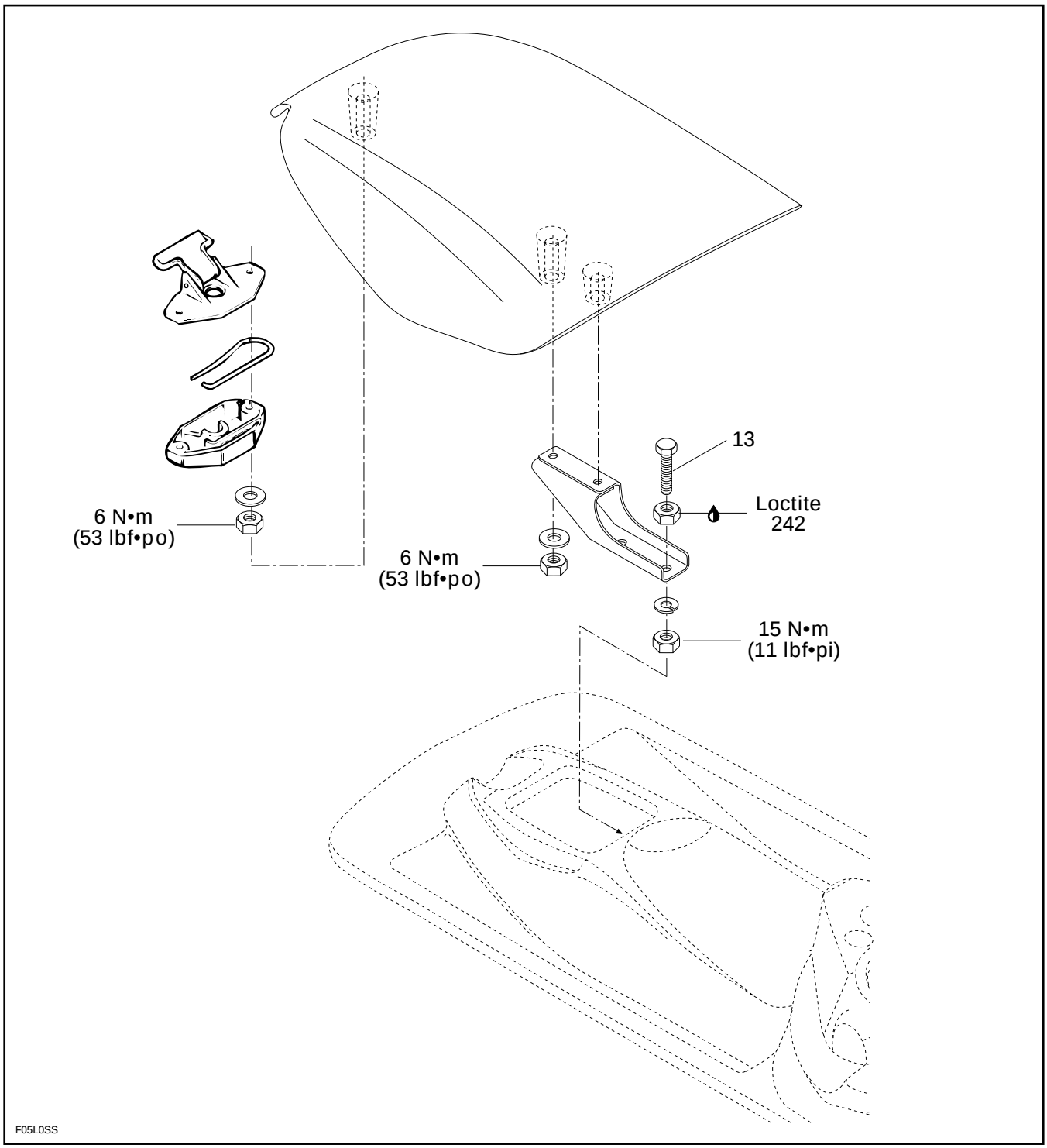
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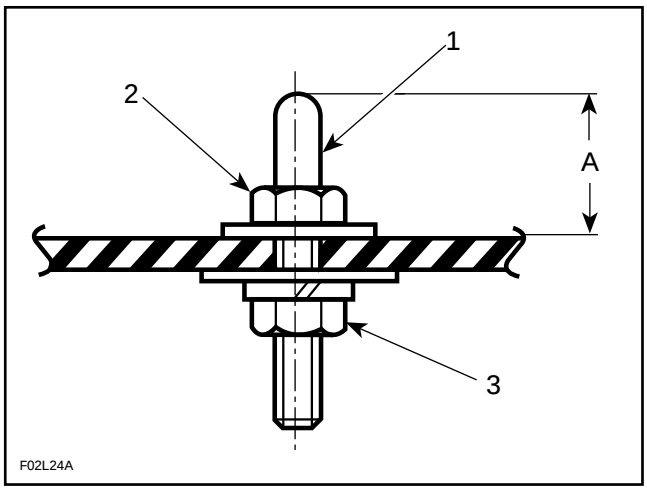
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SEAT ADJUSTMENT

All Models Except HX

1, Front Hook

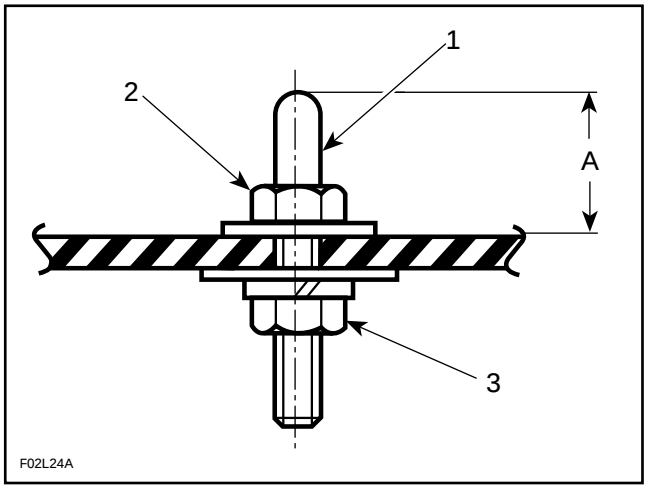
Adjust front hook as per following specifications :



SP / XP SERIES

1. *Front hook*
2. *Adjustment nut (Loctite 271)*
3. *Nut (Loctite 242). Torque to 8 N•m (71 lbf•in)*

A. 25 ± 1 mm (63/64 ± 3/64 in)



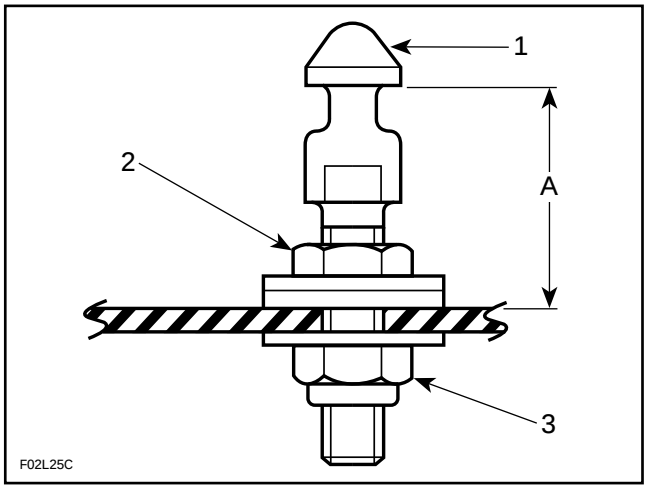
GTS / GTI MODELS

1. *Front hook*
2. *Adjustment nut (Loctite 271)*
3. *Nut (Loctite 242). Torque to 8 N•m (71 lbf•in)*

A. 22.5 (+1, –0) mm (51/64 (+1/32, –0) in)

2, Lock Pin

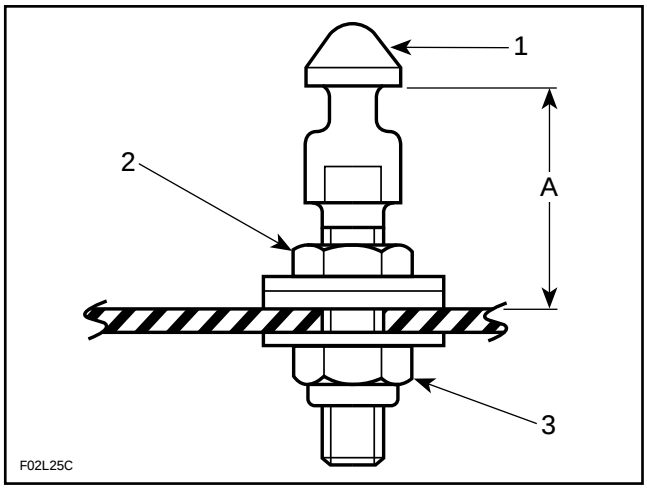
Adjust lock pin of seat as per following specifications.



SP / XP SERIES

1. *Lock pin*
2. *Adjustment nut (Loctite 271)*
3. *Lock nut. Torque to 5 N•m (44 lbf•in)*

A. 37 ± 1 mm (1-29/64 ± 3/64 in)



GTS / GTI MODELS

1. *Lock pin*
2. *Adjustment nut (Loctite 271)*
3. *Lock nut. Torque to 5 N•m (44 lbf•in)*

A. 38 ± 1 mm (1-1/2 ± 3/64 in)

NOTE : If watercraft is equipped with a optional storage tray, height of lock pin and front hook must be raised by 2 mm (5/64 in).

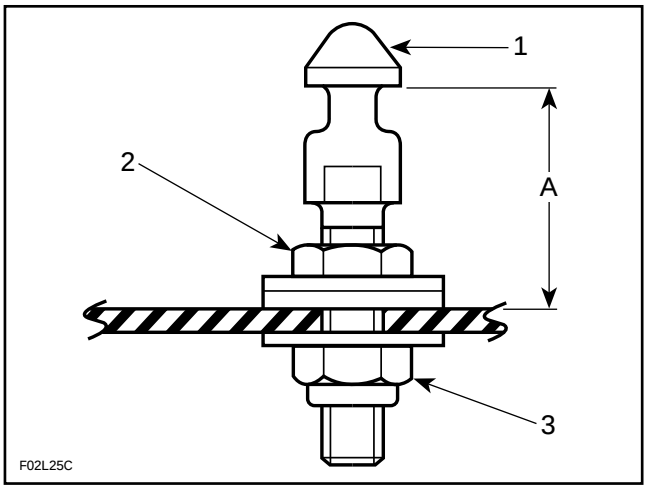
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STORAGE COMPARTMENT COVER ADJUSTMENT

All Models Except HX

3, Lock Pin

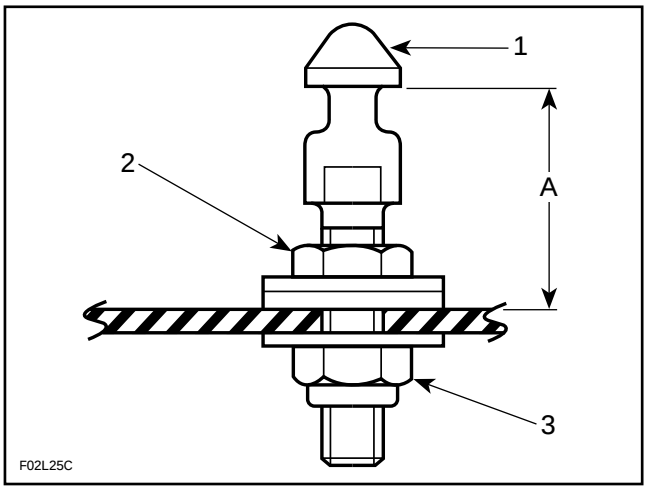
Adjust lock pin of storage compartment cover as per following specifications.



SP / XP SERIES

1. *Lock pin*
2. *Adjustment nut (Loctite 271)*
3. *Lock nut. Torque to 5 N•m (44 lbf•in)*

A. 37 ± 1 mm (1-29/64 ± 3/64 in)



GTS / GTI MODELS

1. *Lock pin*
2. *Adjustment nut (Loctite 271)*
3. *Lock nut. Torque to 5 N•m (44 lbf•in)*

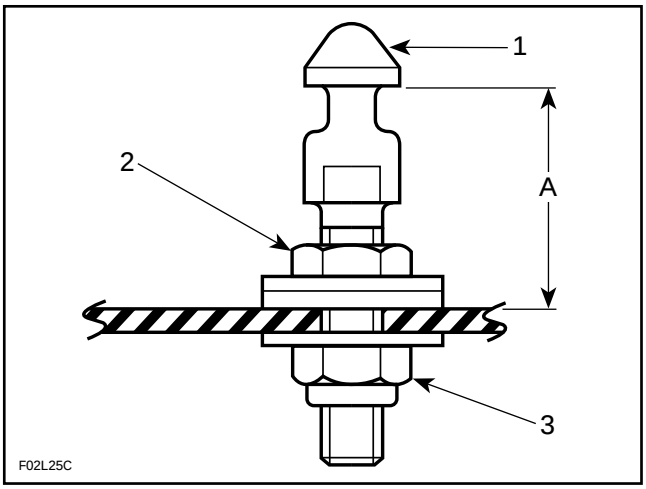
A. 37 (+0.5, –1) mm (1-3/64 (+1/64, –1/32) in)

ACCESS PANEL ADJUSTMENT

HX Model Only

3, Lock Pin

Adjust lock pin of access panel as per following specifications.

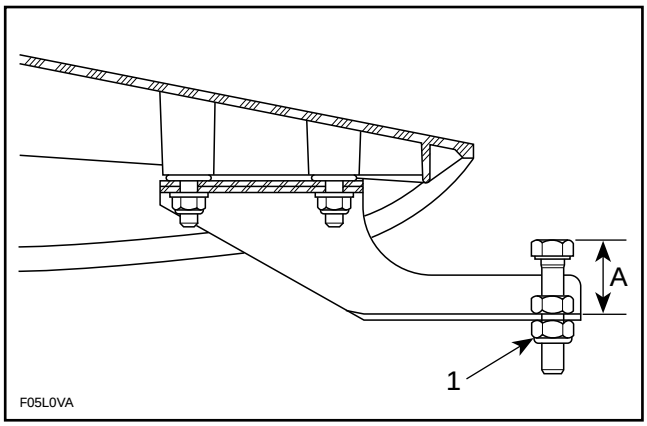


1. *Lock pin*
2. *Adjustment nut (Loctite 271)*
3. *Lock nut. Torque to 5 N•m (44 lbf•in)*

A. 47 ± 1 mm (1-27/32 ± 3/64 in)

13, Bolt

Adjust bolts of access panel arms as per following specifications.



1. *Lock nut. Torque to 15 N•m (11 lbf•ft)*

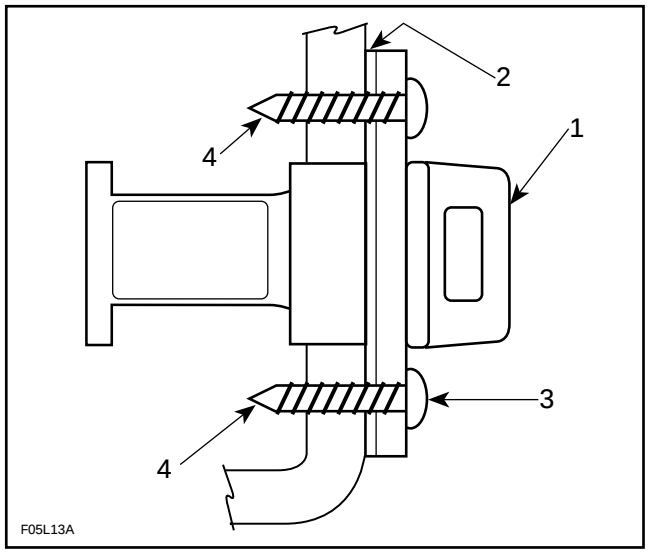
A. 25 ± 1 mm (63/64 ± 3/64 in)

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DRAIN PLUG INSTALLATION

14, Drain Plug

Refer to the following illustration for drain plug installation.

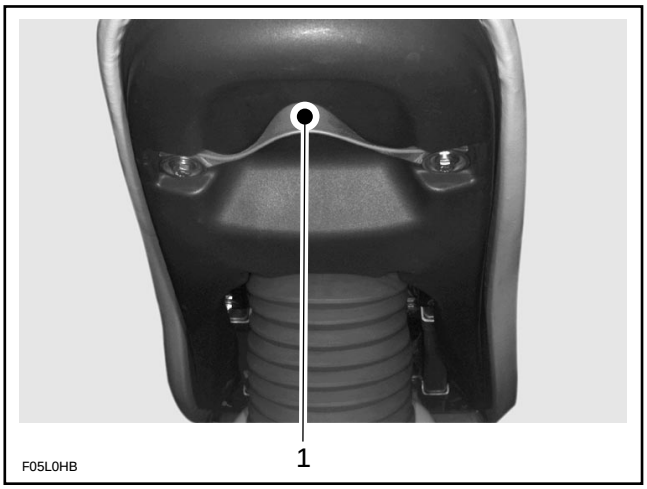


1. *Drain plug*
2. *Gasket and 732 sealant*
3. *Torque screws to 1.5 N•m (13 lbf•in)*
4. *From inside bilge, apply 732 sealant on screws*

SEAT REMOVAL

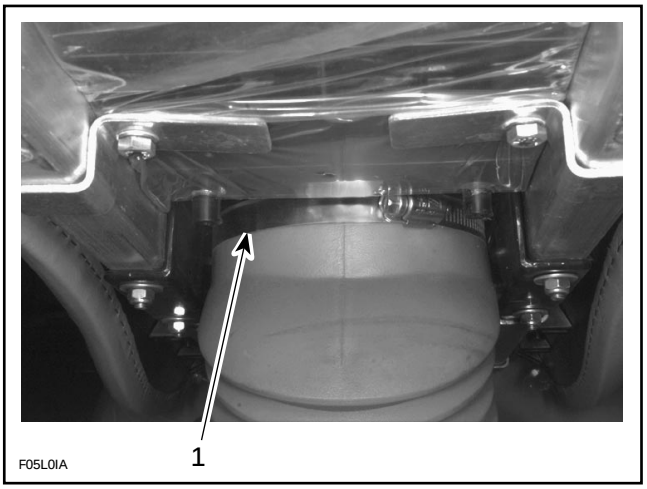
HX Model Only

Remove bottom cover of seat with grab handle.



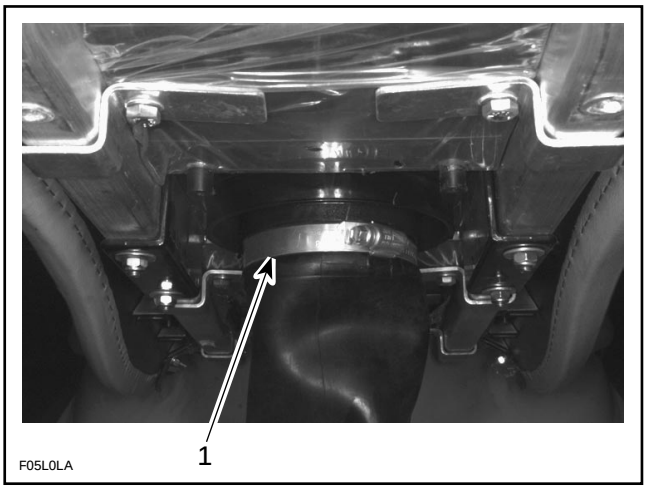
1. *Cover*

Loosen collar of coil over shock outer bootþ; then, pull outer boot downward.



1. *Collar*

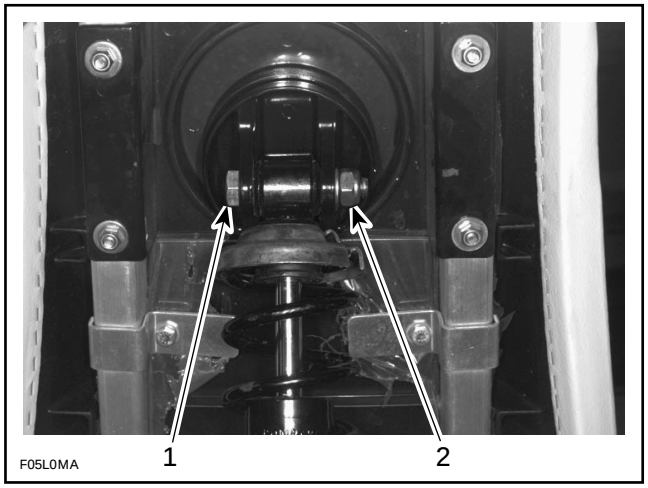
Loosen upper collar of coil over shock inner bootþ; then, pull boot downward.



1. *Collar*

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Remove bolt and lock nut from shock absorber upper support.



1. Bolt
2. Lock nut

Tilt seat.

Loosen side screws retaining seat frame to pivot blocks.

Lower seat.

Loosen upper screws retaining seat frame to pivot blocks.

Remove seat.

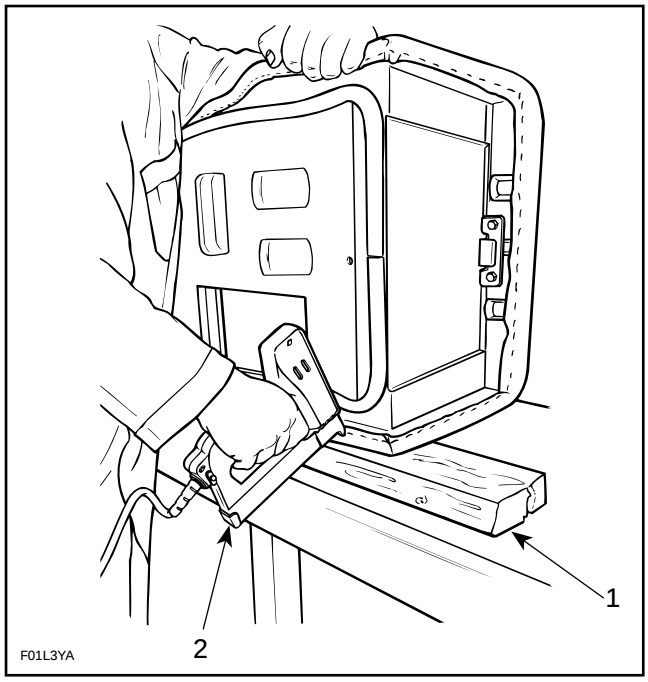
Seat installation is essentially the reverse of removal procedure. Refer to the main illustration of seat at the beginning of this section for proper torque specifications and service products to be used.

SEAT COVER REPLACEMENT

Install staples with an electric tacker such as Arrow tacker no. ETN-50 or with a manual tacker such as Arrow tacker no. T-50.

NOTE : For an easier installation, it's highly recommended to use an electric tacker.

Ensure that the seat rest firmly against a hard surface such as a piece of wood. This is done to get the staples completely pushed in place.



TYPICAL

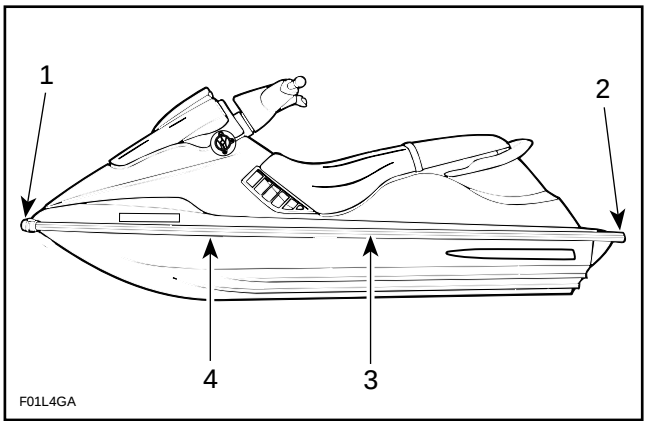
1. Piece of wood
2. ETN-50 (electric) or T-50 (manual)

After cover installation cut all around the excess of material.

BUMPER REPLACEMENT

4,5,12, Bumper, Trim and Rivet

1. Remove trim from side bumper rail.
2. Drill pop rivets to remove side bumper rail.
3. Mark hole positions on body straight and bow sections.



1. Front bumper
2. Corner bumper
3. Straight section
4. Bow section

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4. Slide bumper rail under front bumper.
5. Using a 4.80 mm (3/16 in) drill bit, drill first hole through bumper rail at front of bow section. Use locating mark as a guide. Then install a rivet.

▼ CAUTION : When drilling, be careful not to damage bumper rail and / or hull.

6. Position bumper rail properly onto body and cut excess length if necessary.
7. Slide bumper rail in corner bumper.
8. Using hole positions previously marked on body, drill holes in bumper rail and install rivets.
9. Install trim using soapy water.
10. Repeat procedure for the other side.

SPONSON REPLACEMENT

6,7,8,9,10, Sponson, Gasket, Washer, Lock Washer and Nut

Remove seat.

Remove air vent tube support (SP / XP series).

Remove muffler.

From bilge, unscrew sponsons using a 10 mm deep socket with an extension.

Remove sponsons. Clean any residus of sealant adhesive on hull.

Install gaskets on new sponsons.

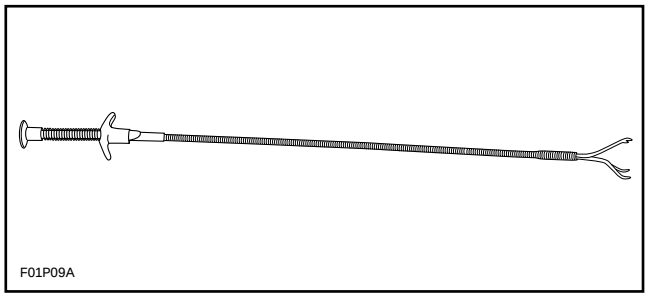
Apply sealant 732 (P / N 293 800 006) or sealant adhesive (P / N 293 800 033) around sponson studs.

Apply Loctite 242 (blue) on sponson studs.

Install sponsons on hull.

From bilge, first insert flat washers over sponson studs, then lock washers. Secure with lock nuts. Tighten to 5 N•m (44 lbf•in).

○ NOTE : To ease flat washer and lock washer installation, use a flexible 4-claw Snap-on pick-up tool.



Reinstall muffler. Tighten hose clamps to 4 N•m (35 lbf•in).

Reinstall air vent tube support (SP / XP series).

Reinstall seat.

Clean hull and sponsons of any sealant adhesive surplus.

◆ WARNING : Recommended torques and use of Loctite must be strictly followed.

BAFFLE SEALING (GTS / GTI MODELS)

11, Rear Baffle

Apply Sikaflex primer 449 (P / N 293 530 012) on rear baffle and body sections to be sealed.

▼ CAUTION : Allow at least 30 minutes for primer to cure.

Apply Sikaflex sealant 221 (P / N 293 530 011) on rear baffle section to be sealed.

Before using the watercraft wait 3 days for Sikaflex curing time.

HOOD REMOVAL

HX Model Only

Disconnect throttle and choke cables at carburetor linkage.

Disconnect wiring harnesses of startþ/þstop button, monitoring beeper and safety lanyard switch.

Loosen bolts and nuts of hinge from watercraft body.

Remove hood.

Hood installation is essentially the reverse of removal procedure. Refer to the main illustration of hood at the beginning of this section for proper torque specifications and service products to be used.

DECALS REPLACEMENT

Removal

Using a heat gun warm up one end of decal for a few seconds until decal can roll off when rubbing with your finger.

Pull decal slowly and when necessary apply more heat to ease removal on the area that has to be peeled off.

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If decal tears while pulling off, it has to be heated for a few seconds longer. If decal tends to stretch while pulling off, stop heating and wait a few seconds to let it cool, then peel it off.

Installation

There are 2 types of decals used on watercraft. One has a protective film on back side and the other has a protective film on both sides. They are used on 3 types of materials ; plastic, gelcoat and metal.

DECALS HAVING A PROTECTIVE FILM ON BACK SIDE ONLY

These decals usually contain written information (ex. : warning) and are used on gelcoat or metal.

Clean surface with a good solvent such as ACRYLICLEAN DX 330 from PPG or equivalent (refer to manufacturer instructions).

Using a pencil and the decal as a template, mark the area where decal will be located.

Remove half of the decal back protective film and align decal with marks. Start sticking it from center and remove the other half of the film to stick it completely. Carefully squeegee decal beginning at center and working outward using, firm, short, overlapping strokes.

DECALS HAVING A PROTECTIVE FILM ON BOTH SIDES

These decals usually contain graphics and are used on gelcoat or plastic.

INSTALLATION ON GELCOAT

Clean surface with a good solvent such as ACRYLI-CLEAN DX 330 from PPG or equivalent (refer to manufacturer instructions).

For best result apply an activator (P / N 293 530 036) to prepare the surface using a clean cloth. After a few seconds, when the activator evaporates, the surface is ready.

Using a pencil and the decal as a template mark the area where decal will be located.

For better adhesion a dry application is recommended, however, to ease decal installation a mild solution of soapy water can be sprayed over surface where decal will be installed.

Remove back protective film from decal and align decal with marks. When well aligned squeegee decal beginning at center and working outward using firm, short, overlapping strokes.

Remove front protective film once decal has adhered to hull.

Installation on Plastic (Storage Cover)

Clean surface with isopropyl alcohol.

Using a pencil and the decal as a template, mark the area where decal will be located.

Apply an activator (P / N 293 530 036) to prepare the surface using a clean cloth. After a few seconds, when the activator evaporates, the surface is ready.

▼ CAUTION : Do not use soapy water to locate decal on plastic parts.

Remove back protective film from decal and carefully align decal with marks. When well aligned squeegee decal beginning at center and working outward using firm, short, overlapping strokes.

Remove front protective film once decal has adhered.

HULL AND BODY REPAIR

General

Gelcoat is the smooth and durable cosmetic finish which coats the fiberglass hull and body of a Sea-Doo watercraft. It also provides a protective barrier against water and sun. It consists of a mixture of resin, pigment (coloring), fillers, monomers and catalyst which is sprayed into the mold.

The body and hull of the Sea-Doo are constructed of chopped fiberglass, saturated with resin. It is sprayed on the layer of gelcoat along with pieces of fiberglass mat, cloth and woven rowing which are added at required areas. This type of construction is very accommodating for high quality repairs. With patience, the proper techniques and materials, a damaged area can be restored to an original finish.

○ NOTE : Fiberglass repair kit is available through automotive or marine suppliers. Gelcoat repair kits are available through regular channel. Refer to SERVICE TOOLS AND PRODUCTS 01-03.

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◆ WARNING : Protect skin, wear gloves when in contact with resin, hardeners and gelcoat. A barrier skin cream may also be used. Do not expose area to open flame or lit cigarette. Some of the materials are flammable. Protect eyes, wear safety glasses when grinding, sanding or spraying. Use a dust mask when sanding or grinding. When spraying wear a respirator or paint mask. Always read warning labels on products.

Air Bubbles

Possible Cause :

– Air pocket trapped between layers of laminate and gelcoat.

PREPARATION OF SURFACE

Remove all of the damaged gelcoat surrounding the air bubble with a putty knife or preferably a carbide grinding tip. Make sure all loose and weak areas are completely removed. Sand a small area of the gelcoat surface with 220-grit sandpaper. If needed, sand the cavity itself. These areas must have a rough surface to allow the gelcoat putty to bond properly.

FILLING THE CAVITY

The prepared surface must be cleaned with acetone on a cloth. Use the Bombardier gelcoat repair kit (P / N 295 500 100). Follow the mixing instructions in the kit when preparing the gelcoat putty.

Carefully mix the required amount while making sure there are no air bubbles in the mixture. With a putty knife fill the repair area and cover with plastic film. Curing time may depend on temperature, amount of putty and percentage of catalyst. After 2 hours, press lightly on the surface with fingers to test the hardness. When the area becomes hard, remove the plastic film.

SANDING

Begin block sanding the patch with 320-grit sandpaper until you come close to the original surface. Remove dust with a water soaked cloth and continue sanding with a 400-grit wet paper. Finish wet sanding with a 600-grit to remove deeper scratches. If needed you can wet sand with finer grit paper such as 1000-grit.

BUFFING AND WAXING

Buff the surface using a heavy duty polisher with a buffing pad. Make sure the pad is free of dirt or you may damage the gelcoat. Carefully begin buffing with a white medium compound (RM 856). Finish off using a fine compound (RM 852). While buffing, pay close attention to avoid overheating the surface.

Blisters

Possible Causes :

– Insert catalyst.

– Improper catalyst / gelcoat ratio.

A blister is a visible bump on the watercraft surface that may not necessarily come right through the gelcoat layer. In the case of only a few blisters, follow the same repair procedure as for air bubbles. If they are numerous and in close concentration, spray liquid gelcoat to achieve proper repair. This procedure is covered in the next problem.

Minor Gelcoat Fractures

Possible Causes :

– Flexing of fiberglass laminate.

– Gelcoat thickness.

– Direct result of impact.

In case of fractures which have not penetrated past the gelcoat layer, the repair concerns the gelcoat only. If flex cracking or impact are evident, then additional reinforcement may be necessary. This subject will be covered in the next problem.

PREPARING THE SURFACES

Small Fractures :

Open the cracks up with a sharp triangular can opener or preferably a carbide tipped die grinder. The V groove will provide a good bonding area for the gelcoat. With 220-grit sandpaper, sand the sides of the notched out areas.

Numerous Fractures :

Using a grinder with a 24-grit disk, remove the gelcoat. Sand the area edge with 220-grit sandpaper.

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FILLING THE REPAIR AREA

Small Fractures :

Refer to the same procedure as in the air bubbles.

Numerous Fractures Over Large Surface :

Prepare the area for spray application of liquid gelcoat. Wipe down the surface with acetone. Mask the area off to protect the watercraft from overspray.

Mix the needed quantity of gelcoat and catalyst according to suppliers recommendations. The gelcoat can be thinned with acetone up to 10%. If it needs more consistency you can add cabosil.

Make sure that the air supply is free of oil, dirt and water.

Test spray the gelcoat mixture on paper to verify its consistency and pattern. You may have to apply 5 or 6 coats to cover the area properly. Overlap each coat further than the last, leaving at least 30 seconds between passes. Avoid trying to coat the surface with only a few heavy coats, this will not allow the gelcoat to dry properly.

Apply a coat of polyvinyl alcohol to seal off the air and protect the gelcoat surface from dust. PVA speeds up the curing process because gelcoat will not cure properly when exposed to air.

SANDING

Wash the polyvinyl alcohol off with water. Depending on the size of the area repaired, you can either block sand as per previous procedure or you may use an air sander. Sand the surface down with progressively finer grits of sandpaper until the desired finish is achieved.

BUFFING AND WAXING

Buff the surface using a heavy duty polisher with a buffing pad. Make sure the pad is free of dirt or you may damage the gelcoat. Carefully begin buffing with a white medium compound (RM 856). Finish off using a fine compound (RM 852). While buffing, pay close attention to avoid overheating the surface.

Compound Fractures

Possible Causes :

– Thickness of fiberglass laminate.
– Direct result of impact.

Compound fractures are those that have gone past the gelcoated surface and in through the layers of fiberglass laminate. Two types of repairs have to be performed. The first is to restore the structural integrity of the damaged area. Fracture types can vary from a simple crack to a large hole. Usually, fiberglass reinforcement becomes necessary, especially if the fracture can be attributed to weakness. The final part of the repair is the gelcoating, which cannot be done until the interior and exterior laminate surfaces have been repaired.

Outside :

Remove the damaged gelcoat and fiberglass with a 24-grit disk using a power sander. Grind outward at least 2 inches from the fracture to allow the patch to bond to strong material. Cut enough pieces of fiberglass mat necessary to build up the area. The pieces should be cut so they overlap each other by at least a half inch. For a smoother finish, the last layer should be fiberglass cloth. If the fracture is small enough all you may have to do is fill the area with an epoxy filler.

Inside :

For the interior repair, you can grind more. This will allow for more fiberglass material which will strengthen the area. If the fracture opening is too large after surface preparation, you may need a backing support to cover the opening. Cut alternating pieces of fiberglass mat and cloth in overlapping sizes.

PATCHING THE REPAIR AREA

Outside :

The outside should be done first. Wipe clean the area with acetone on a cloth, then mask off area. For a small crack use an epoxy filler in the same way you would use Bombardier's gelcoat repair putty. When laying up a larger area you will use mat, cloth and fiberglass resin and hardener. Use a clean container to mix the resin, mix only what you will need. Follow the recommended catalyst ratio.

Using a clean paintbrush, brush the mixed resin on the surface. Place the smallest piece of mat over the fracture and then wet out the mat. Follow with the remaining pieces of mat and final layer of cloth. While wetting the pieces make sure you work the air bubbles out and saturate all the pieces evenly. Try to work quickly, you may only have 15 or 20 minutes. You may clean the brush with acetone.

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Wait until the repair has hardened before moving on to the interior repair. If the size of the opening is too large for the pieces to maintain the proper shape, you will have to use a backing support. It is a shaped piece of cardboard that fits flush to the interior surface and has a plastic layer on the repair side. It is held in place by tape or a support.

Inside :

Wipe down the area with acetone on a cloth. Apply the same procedure as for outside repair when laminating the alternating pieces of fiberglass material. If a backing support was used, remove it before starting the repair. After the area has hardened, remove sharp edges of material from surface. If required paint the surface.

SANDING

Outside :

This surface will have to be prepared for application of gelcoat. The size of the area will determine the gelcoating procedure to be used. Refer to the repair procedure for minor gelcoat fractures.

BUFFING AND WAXING

Refer to the buffing and waxing for minor gelcoat fractures. If painting the exterior is preferred, refer to HULL / BODY 11-02.

Tools and Materials List

Tools

- safety glasses
- air mask
- white cloths
- sanding block
- putty knife
- plastic film
- stirring stick
- cover sheets (for Sea-Doo)
- scissors
- buffing pad
- heavy-duty polisher
- power sander
- paint brush
- plastic container (mixing)
- spray gun
- plastic squeegee

Materials

- fiberglass mat
- fiberglass cloth
- polyester resin
- cardboard
- masking tape
- sandpaper

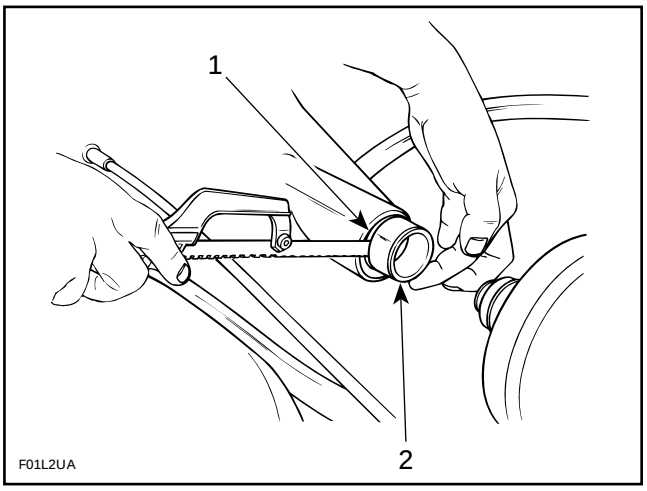
(100-grit, 220-grit, 320-grit, 400-grit, 600-grit, 1000-grit)

- 24-grit sanding disks
- Bombardier gelcoat putty
- Bombardier liquid gelcoat
- acetone
- cabosil
- epoxy filler
- medium compound (white)
- fine compound (white)
- wax

HULL INSERT REPAIR

For hull insert repair proceed as follows :

Cut plastic hull insert flush with hull using a saw.



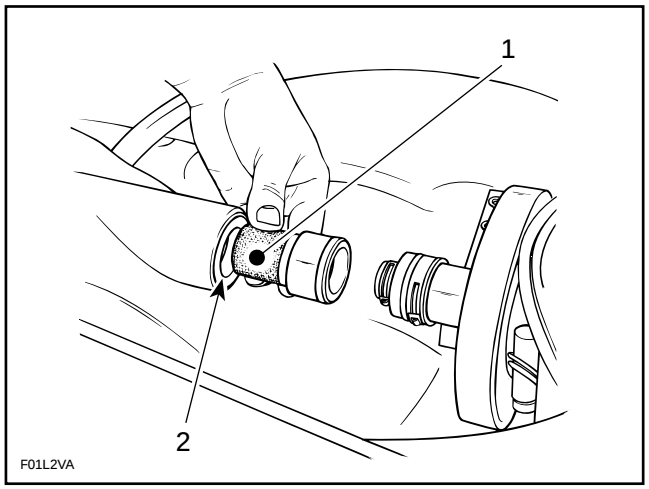
1. Hull
2. Plastic hull insert

Mix epoxy glue (3M-05900), follow manufacturer instructions.

Apply epoxy glue on aluminum insert (P / N 292 000 075) knurled surface and on plastic insert inner bore.

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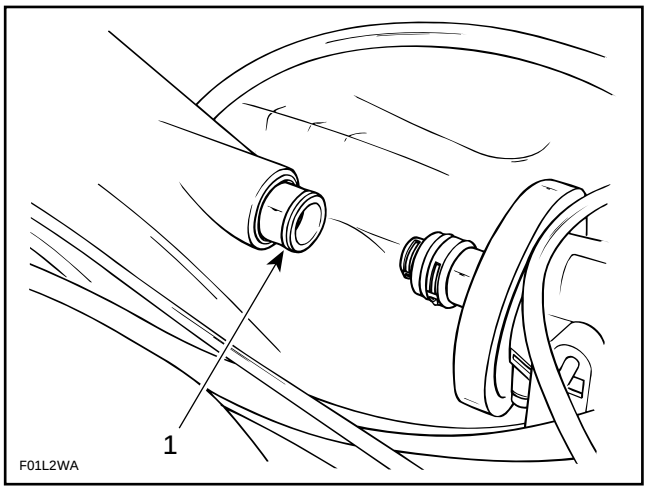
CAUTION : If you notice any clearance between plastic insert and aluminum insert, fill gap with epoxy glue to obtain good adhesion of aluminum insert.



1. Knurled surface
2. Inner bore

Install aluminum insert into plastic hull insert.

NOTE : Align aluminum insert as much as possible with PTO flywheel.



1. Aluminum insert

NOTE : The epoxy glue curing time is 30 minutes.

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PAINTING

GENERAL

The following was prepared in conjunction with PPG Industries Inc. It contains a list of SEA-DOO parts with their respective PPG color codes and 2 painting procedures ; CONCEPT ™ the most commonly used and DELTA ™ (with low VOC) mainly used in California.

PPG Industries Inc. sells paint and related products and these are not available through Bombardier Inc. network. To find your nearest PPG dealer, dial one of the following numbers.

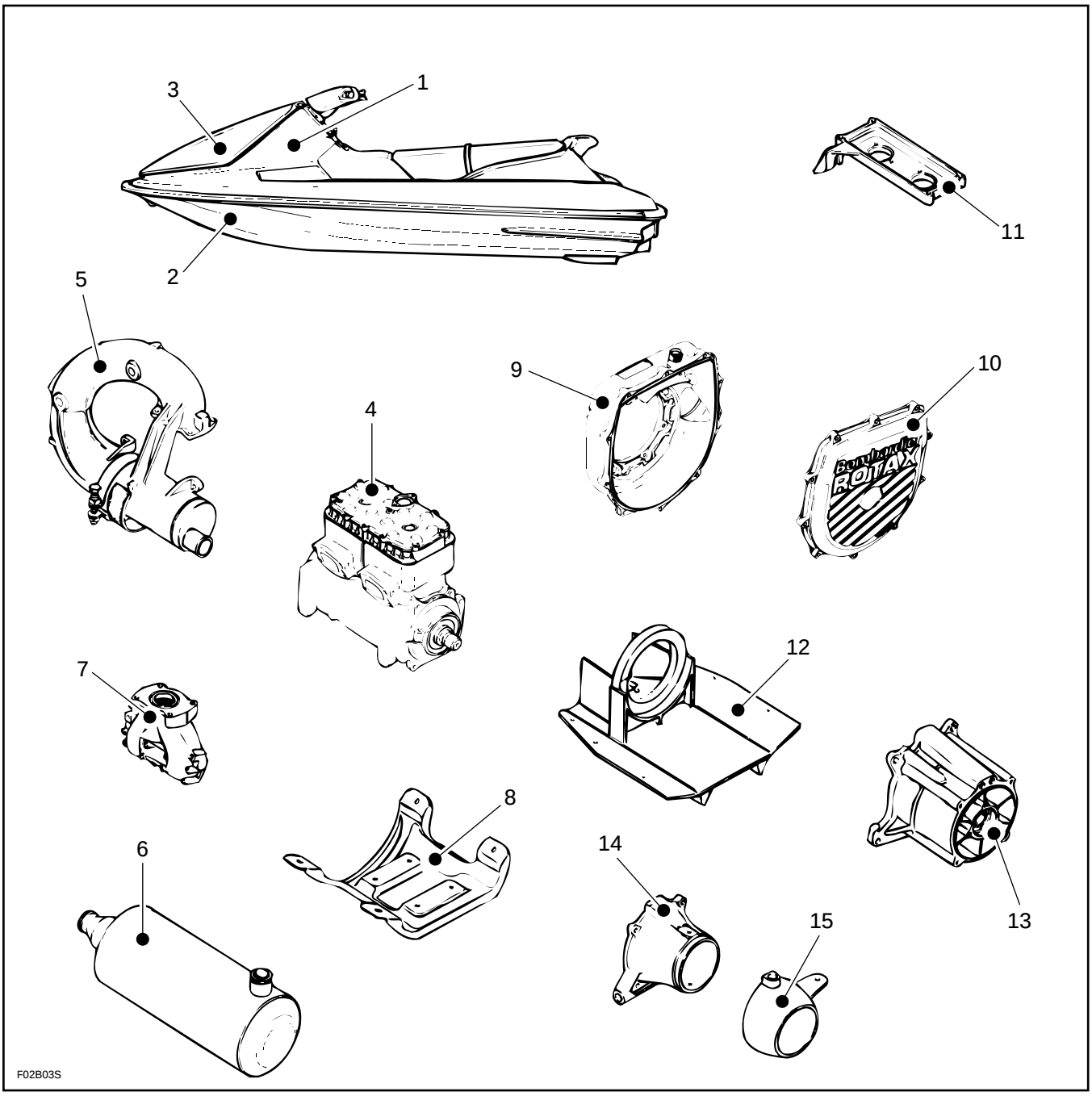
NORTH AMERICA	CANADA	Quebec Phone : 1-800-363-2816	All Others Provinces Phone : 1-905-855-5802 Communications are available in english and french.	
	U.S.A	Phone : (216) 572-6100 This phone number is also good for all countries. Communications are available in english, french and spanish.		
EUROPE	DENMARK	Phone : 45-31-54-9211	PORTUGAL	Phone : 351-230-17-43
	FRANCE	Phone : 33-1-48-35-7777 33-27-14-9700 33-27-14-4600	SPAIN	Phone : 34-3-588-2000 34-3-711-51-54 34-6-154-7035 34-83-54-0400 / 04
	GERMANY	Phone : 49-202-788-1	SWEDEN	Phone : 46-479-14-445
	ITALY	Phone : 39-81-831-1222 39-2-37-701 39-131-7701	UNITED KINGDOM	Phone : 44-21-455-9866 44-926-410-255
PACIFIC RIM	JAPAN	Phone : 81-3-3280-2851	KOREA	Phone : 82-32-529-8141 82-32-523-8600 82-51-624-8221 82-2-792-2477

PPG paint for Sea-Doo watercraft is not available in spray can. For best result it must be applied by a professional painter.

For fast touch up on metallic and gelcoat surfaces, refer to the appropriate Bombardier *Sea-Doo Parts Catalog* to find the available products.

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PARTS THAT CAN BE PAINTED



1. *Body*
2. *Hull*
3. *Storage Cover (if applicable)*
4. *Engine*
5. *Tuned Pipe*
6. *Muffler*
7. *Exhaust Manifold*
8. *Engine Support*
9. *Magneto Housing*
10. *Magneto Housing Cover*
11. *Flame Arrester Base*
12. *Ride Shoe*
13. *Impeller Housing**
14. *Venturi**
15. *Steering Nozzle**

**Except for parts made of plastic.*

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PPG COLOR CHART		SEA-DOO MODELS					
		SP SPI	SPX	XP	HX	GTS	GTI
1. Body	COLOR PPG no.	White 98260	White 98260	Yellow M506	White 98260	White 98260	White 98260
2. Hull	COLOR PPG no.	White 98260	Marine green M511	Yellow M506	Yellow 88243	White 98260	White 98260
3. Storage cover (hood for the HX model)	COLOR PPG no.	Not applicable	Not applicable	Not applicable	Yellow 88243	Marine green M511	Yellow M506
4. Engine	COLOR PPG no.	White 98209	White 98209	White 98209	White 98209	White 98209	White 98209
5. Tuned pipe	COLOR PPG no.	Purple 59962	Purple 59962	Purple 59962	Purple 59962	Purple 59962	Purple 59962
6. Muffler	COLOR PPG no.	Purple 59962	Purple 59962	Purple 59962	Purple 59962	Purple 59962	Purple 59962
7. Exhaust Manifold	COLOR PPG no.	White 98209	White 98209	White 98209	White 98209	White 98209	White 98209
8. Engine support	COLOR PPG no.	Black 9551	Black 9551	Black 9551	Black 9551	Black 9551	Black 9551
9. Magneto housing	COLOR PPG no.	White 98209	White 98209	White 98209	White 98209	White 98209	White 98209
10. Magneto housing cover	COLOR PPG no.	White 98209	White 98209	White 98209	White 98209	White 98209	White 98209
11. Flame arrester base	COLOR PPG no.	Black 9551	Black 9551	Black 9551	Black 9551	Black 9551	Black 9551
12. Ride shoe	COLOR PPG no.	Black 9551	Black 9551	Black 9551	Black 9551	Black 9551	Black 9551
13. Impeller housing ①	COLOR PPG no.	Black 9551	Black 9551	Black 9551	Black 9551	Black 9551	Black 9551
14. Venturi ①	COLOR PPG no.	Black 9551	Black 9551	Black 9551	Black 9551	Black 9551	Black 9551
15. Nozzle ①	COLOR PPG no.	Black 9551	Black 9551	Black 9551	Black 9551	Black 9551	Black 9551

①*Except for plastic parts*

NOTE : Due to natural discoloration, it may be necessary to completely repaint the part.

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CONCEPT™ PAINTING PROCEDURE

For additional information refer to PPG P-Bulletin no. 168.

SURFACE PREPARATION

Prepare and clean surface consistent with good painting practices.

Primer

DP Epoxy Primer / DP 401 Catalystþ; DX 1791 / 1792 (Prime before top coating).

Primer Surfacer

K36 / K201, K200 / K201 or DZ KONDAR® Primer Surfacers.

NOTE : KONDAR must be sealed before applying CONCEPT color.

Sealer

KTS30 2K Sealer, DP Epoxy Primer reduced as a sealer or DAS 1980 or DAS 1987.

Direct Gloss Color

How to Mix

Standard Air Dry : Mix CONCEPT Color 2:1:1 - 2 parts color with 1 part DT Reducer best suited to shop temperatures and 1 part DU 4 Hardener below 29°C (85°F) or DU 5 Hardener above 29°C (85°F).

Standard Force Dry : Mix CONCEPT Color 2:1:1 - Application temperatures below 29°C (85°F) use DU 5 Hardener, above 29°C (85°F) use DU 6.

Medium Solids (MS) Application : For faster film build, when using solid colors, mix 2 parts CONCEPT color with half part DT Reducer and 1 part DU 5 or DU 6 Hardener. Select the DT Reducer appropriate for shop temperature.

Pot Life

Pot life of ready-to-spray CONCEPT color is 6 to 8 hours at 21°C (70°F). Medium solids option is 2 to 4 hours at 21°C (70°F).

FULL PANEL AND OVERALL REPAIRS

Application

Apply 1 medium wet coat and give 5-10 minutes flash, followed by 2 wet coats with 15 minutes flash time between each coat. Adjust metallic on the last full wet coat. If necessary, apply a mist coat. For medium solids option apply 2 full wet coats.

Air Pressure

275-345 kPa (40-50 PSI) at the gun.

Dry Time

- Dust freeþ: 30 minutes.
- Tack freeþ: 2 to 3 hours.
- Tape print freeþ: 6 hours.
- Dry to handleþ: 6 to 8 hours at 21°C (70°F).
- Force dryþ: 40 minutes at 60°C (140°F).

Faster dry times may be obtained by using 15 mL (1/2 oz) of DXR 81 Accelerator per sprayable quart, however, the pot life is reduced to 2 hours.

SPOT / PANEL REPAIRS

Application

Spray medium wet coat of color on the repair area and allow 5-10 minutes flash time. Apply 2 additional full coats until hiding is achieved, extending each coat beyond the previous coat. Flash 15 minutes between each coat. For medium solids option apply 2 full wet coats.

Blending

Add DT 95 Reducer to a second gun cup. Reduce the fluid feed of the gun and lower the air pressure to 207 kPa (30 PSI). Dust the dry edge until a slight wet look appears, then stop. Or mix reduced and catalyzed color with equal parts of reduced and catalyzed CONCEPT DCU 2020 Clear.

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DELTA™ PAINTING PROCEDURE

(with low VOC, mainly in California)

For additional information refer to *PPG P-Bulletin* no. 157.

SURFACE PREPARATION

Primerþ: DELTA™ PRIME DPU 166.

DELTA™ 2800, COLOR

How to Mix

Mix DELTA™ 2800 2:1, 2 parts Colors to 1 DU 6 Catalyst.

Application

Apply 2 coats of DELTA™ Polyurethane Color. Apply the first coat at 1.5 -1.8 wet mils. Allow a minimum of 15 minutes flash time prior application of the second coat. Apply a second coat of DELTA™ using the same technique as the first application, paying strict attention to gun set up and proper equipment choices.

RECOMMENDED SPRAY EQUIPMENT

Gun Manufacturer	De Vilbiss	Binks	Graco	HVLP
Gun Model	JGA	62	800N	Can Am Model 900
Fluid Type	FF 1.4 mm (0.055 in)	63D 1.5 mm (0.059)	02N 1.2 mm (0.047 in)	HT no. 9072 2.5 mm (0.098 in)
Air Cap	797 / 264	63 PW	02 / 03	C9062
Gun Distance	25 - 30 cm (10 - 12 in)	25 - 30 cm (10 - 12 in)	25 - 30 cm (10 - 12 in)	25 - 30 cm (10 - 12 in)
Fluid Delivery	227 - 340 mL / min. (8 - 12 oz / min.)	227 - 340 mL / min. (8 - 12 oz / min.)	227 - 340 mL / min. (8 - 12 oz / min.)	227 - 340 mL / min. (8 - 12 oz / min.)
Air Pressure (At-the-Gun)	414 - 517 kPa (60 - 75 PSI)	414 - 517 kPa (60 - 75 PSI)	414 - 517 kPa (60 - 75 PSI)	62 kPa (9 PSI)

Dry Time at 21°C (70°F)

- Dust freeþ: 25-35 minutes.
- Tack freeþ: 2-1/2 to 3 hours.
- Tape / Sandþ: Overnight.

Force Dry

Allow 20 minutes purge time at 27-32°C (80-90°F) before bake. Bake 75 minutes at 65°C (150°F) or 40 minutes at 82°C (180°F). Allow to cool after force dry, before sanding or taping.

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SP AND SPI MODELS

ENGINE		SP (5876)	SPI (5878)
Engine type		Bombardier-Rotax 587	
Induction type		Rotary valve	
Exhaust system	Type	Water cooled, water injected	
	Water injection fitting	4.6 mm (.181 in)	
Starting system		Electric start	
Lubrication	Fuel / oil mixture	VROI (Variable Rate Oil Injection	
	Oil injection pump	Gear driven	
	Oil type	BOMBARDIER-ROTAX injection oil	
Number of cylinders		2	
Bore	Standard	76.0 mm (2.992 in)	
	First oversize	76.25 mm (3.002 in)	
	Second oversize	76.50 mm (3.012 in)	
Stroke		64 mm (2.520 in)	
Displacement		580.7 cm^3 (35.4 in^3)	
Corrected compression ratio		6.5 : 1	
Cylinder head warpage (maximum)		0.05 mm (.002 in)	
Piston ring type and quantity		1 Semi-trapez – 1 Rectangular	
Ring end gap	New	0.25 - 0.40 mm (.010 - .016 in)	
	Wear limit	1.00 mm (.039 in)	
Ring / piston groove clearance	New	0.05 - 0.08 mm (.002 - .003 in)	
	Wear limit	0.2 mm (.008 in)	
Piston / cylinder wall clearance	New	0.05 - 0.07 mm (.002 - .003 in)	
	Wear limit	0.2 mm (.008 in)	
Cylinder taper (maximum)		0.100 mm (.004 in)	
Cylinder out of round (maximum)		0.080 mm (.003 in)	
Connecting rod bigend axial play	New	0.39 - 0.74 mm (.015 - .029 in)	
	Wear limit	1.2 mm (.047 in)	
Crankshaft deflection		①	
Rotary valve timing	Opening	130° ± 5 BTDC	
	Closing	65° ± 5 ATDC	
Rotary valve duration		147°	
Crankcase / rotary valve gap		0.25 - 0.35 mm (.010 - .014 in)	
Connecting rod / crank-shaft pin radial clearance	New	0.02 - 0.03 mm (.0008 - .0013 in)	
	Wear limit	0.050 mm (.002 in)	
Connecting rod / piston pin radial clearance	New	0.003 - 0.012 mm (.00012 - .00047 in)	
	Wear limit	0.015 mm (.00059 in)	

ADDITIONAL INFORMATION : Squish gap : 1.2 - 1.8 mm (.047 - .071 in).
①MAG side : 0.05 mm (.002 in)
PTO side : 0.03 mm (.001in)

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ELECTRICAL		SP (5876)	SPI (5878)
Magneto generator output		160 W @ 6000 RPM or 4.0 A @ 2000 RPM	
Ignition system type		CDI	
Spark plug	Make and type	NGK BR7ES	
	Gap	0.5þ-þ0.6 mm (.020þ-þ.024 in)	
Ignition timing	mm (in)	2.41 (.095)	
(BTDC)	Degrees	20° ± 1 ①	
Generating coil		40 - 76 ❽	
Battery charging coil		.05 - .6 Ω	
Ignition coil	Primary	Not applicable	
	Secondary	9 - 15 kΩ	
Engine rev limiter setting		6550 ± 50 RPM	
Battery		(Yuasa / Exide) 12 V, 19 A•h	
Fuse	Starting system	5 A	
	Charging system	15 A	
ADDITIONAL INFORMATION : ①Engine cold @ 6000 RPM.			

CARBURETION		SP (5876)	SPI (5878)
Carburetor	Type	Mikuni BN-38 (diaphragm)	
	Quantity	1	
Main jet		142.5	147.5
Pilot jet		65	
Adjustment	Low-speed screw	1-1/4 turn ± 1/4	
	High-speed screw	0	
	Idle speed (in water)	1500 RPM	
	Idle speed (out of water)	2400 RPM	2500 RPM
Fuel	Type	Regular unleaded gasoline	
	Minimum octane no.	87	
Fuel return line orifice		0.8 mm (.031 in)	
ADDITIONAL INFORMATION :			

COOLING	SP (5876)	SPI (5878)
Type	Open circuit – Direct flow from jet propulsion unit	
Thermostat	None	
Monitoring beeper setting	96-99°C (205-210°F)	
ADDITIONAL INFORMATION :		

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PROPULSION		SP (5876)	SPI (5878)
Propulsion system		Bombardier Formula Pump	
Jet pump type		Axial flow single stage	
Impeller rotation (seen from rear)		Counterclockwise	
Transmission		Direct drive	
Coupling type		Crown splines	
Oil type		SEA-DOO JET PUMP SYNTHETIC POLYOLESTER OIL 75W90 GL5	
Steering nozzle pivoting angle		26°	
Trim nozzle pivoting angle		Not applicable	
Minimum required water level		90 cm (35 in)	
Drive shaft deflection (maximum)		0.5 mm (.020 in)	
Impeller outside diameter		139.5 mm (5.490 in)	
Impellerþ/þwear	New	0.18 - 0.44 mm (.007 - .017 in)	
ring clearance	Wear limit	1.02 mm (.040 in)	
Impeller shaft end play (new)		0.12 - 0.54 mm (.005 - .021 in)	
Impeller shaft side play		0.05 mm (.002 in)	
Impeller pitchþ/þmaterial		18.8° / aluminum	Progressive pitch 11°-26° / stainless steel
ADDITIONAL INFORMATION :þDo not mix different brands or oil types.			

DIMENSIONS	SP (5876)	SPI (5878)
Number of passenger (driver incl.)	2	
Overall length	254 cm (100 in)	
Overall width	105 cm (41.3 in)	
Overall height	92 cm (36.2 in)	
Dry weight	176 kg (388 lb)	178 kg (392 lb)
Load limit (passenger and 10 kg (22 lb) luggage)	160 kg	(352 lb)
ADDITIONAL INFORMATION :		

CAPACITIES		SP (5876)	SPI (5878)
Fuel tank		34 L (9 U.S. gal)	
Impeller shaft reservoir	Capacity	90 mL (3 U.S. oz)	
	Oil level height	To bottom of cover hole	
Oil injection reservoir		4.5 L (1.2 U.S. gal)	
ADDITIONAL INFORMATION :			

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MATERIALS	SP (5876)	SPI (5878)
Hull	Composite	
Air intake silencer	Thermoplastic	
Flame arrester	Multi-layer wire screen	
Exhaust muffler	Aluminum	
Steering padding	Thermoplastic elastomer with polystyrene foam	
Fuel tank	Polyethylene	
Oil injection reservoir	Polyethylene	
Seat	Polyurethane foam	
ADDITIONAL INFORMATION :		

STANDARD EQUIPMENT	SP (5876)	SPI (5878)
Safety lanyard	Standard	
Tool kit	Standard	
Fuel tank reserve	Standard	
Monitoring beeper	Standard	
Electric fuel gauge / low oil warning light	Optional	Standard
Tachometer	Optional	
Manual trim system	Optional	Standard
Reverse	Not applicable	
Storage compartment	Standard	
Rear grab handle	Optional	Standard
Extinguisher holder	Standard	
ADDITIONAL INFORMATION :		

PERFORMANCE		SP (5876)	SPI (5878)
Estimated pump power		18.3 kW (24.5 hp)	21.7 kW (29.1 hp)
Maximum fuel consumption at wide open throttle		20.4 L/h (5.5 U.S. gal/h)	22.3 L/h (6 U.S. gal/h)
Cruising time at full throttle	Fuel tank without reserve	1 hour 20 minutes	1 hour 12 minutes
	Fuel tank reserve	15 minutes	14 minutes
ADDITIONAL INFORMATION :			

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TIGHTENING TORQUES		SP (5876)	SPI (5878)	
Exhaust manifold screw		24 N•m	(17 lbf•ft)	(4)
Magneto flywheel nut		145 N•m	(107 lbf•ft)	(1)
Flywheel (PTO side)		110 N•m	(81 lbf•ft)	(5)
Crankcase screws	M8	24 N•m	(17 lbf•ft)	(3) (4)
	M10	40 N•m	(30 lbf•ft)	(3) (4)
Crankcase / engine support nuts		35 N•m	(26 lbf•ft)	(1)
Engine support / hull		25 N•m	(18 lbf•ft)	(1)
Cylinder head screws		24 N•m	(17 lbf•ft)	(4)
Crankcase / cylinder screws		24 N•m	(17 lbf•ft)	(4)
Tuned pipe nut		25 N•m	(18 lbf•ft)	(1)
Tuned pipe fixation screws		25 N•m	(18 lbf•ft)	(1)
Cylinder head cover screws		9 N•m	(80 lbf•in)	
Flame arrester screws		10 N•m	(88 lbf•in)	(1)
Impeller		70 N•m	(52 lbf•ft)	(2)
Pump / hull nuts		35 N•m	(26 lbf•ft)	(1)
Venturi / pump housing screws		25 N•m	(18 lbf•ft)	(1)
Nozzle / venturi screws		20 N•m	(15 lbf•ft)	(1)
Pump housing cover screws		4 N•m	(35 lbf•in)	(1)
Inlet grate screws		8 N•m	(71 lbf•in)	(1)
Ride shoe screws		10 N•m	(88 lbf•in)	(1)
Cable retaining block bolts		6 N•m	(53 lbf•in)	
Steering cableþ/þstem arm bolt		3 N•m	(26 lbf•in)	
Steering stem arm bolts		6 N•m	(53 lbf•in)	
Handlebar clamp bolts		26 N•m	(19 lbf•ft)	
Ball joint bolt		7 N•m	(62 lbf•in)	
Front support bolts		15 N•m	(11 lbf•ft)	(1)
Rear supportþ/þcable bracket bolts		15 N•m	(11 lbf•ft)	(1)
Magneto housing cover screws		9 N•m	(80 lbf•in)	(5)
Starter mounting screws		22 N•m	(16 lbf•ft)	(1)
Starter lock nuts		7 N•m	(62 lbf•in)	
Spark plugs		24 N•m	(17 lbf•ft)	(5)

ADDITIONAL INFORMATION : Apply where indicated ;
(1) Loctite 242 (blue)
(2) Loctite 271 (red)
(3) Loctite 515
(4) Synthetic grease
(5) Anti-seize lubricant

◆ WARNING : Correct torques and use of Loctite must be strictly followed.

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SPX AND XP MODELS

ENGINE		SPX (5877)	XP (5858 / 5859)
Engine type		Bombardier-Rotax 717	Bombardier-Rotax 787
Induction type		Rotary valve	
Exhaust system	Type	Water cooled, water injected	Water cooled, water injected with regulator
	Water injection fitting (head)	3.5 mm	(.139 in)
	Water injection fitting (cone)	3.5 mm (.139 in)	Not applicable
	Water injection fitting (muffler)	Not applicable	3.5 mm (.139 in)
Exhaust valve		Not applicable	Rotax Adjustable Variable Exhaust (RAVE)
Starting system		Electric start	
Lubrication	Fuel / oil mixture	VROI (Variable Rate Oil Injection)	
	Oil injection pump	Gear driven	Direct driven
	Oil type	BOMBARDIER-ROTAX injection oil	Formula XP-S synthetic injection oil
Number of cylinders		2	
Bore	Standard	82 mm	(3.228 in)
	First oversize	82.25 mm	(3.238 in)
	Second oversize	82.50 mm (3.248 in)	Not applicable
Stroke		68 mm (2.68 in)	74 mm (2.99 in)
Displacement		718 cm3 (43.81 in³)	781.6 cm³ (47.7 in3)
Corrected compression ratio		6.2 : 1	5.9 : 1
Cylinder head warpage (maximum)		0.05 mm	(.002 in)
Piston ring type and quantity		1 Semi-trapez – 1 Rectangular	
Ring end gap	New	0.25 - 0.40 mm	(.010 - .016 in)
	Wear limit	1.00 mm	(.039 in)
Ring / piston groove	New	0.025 - 0.070 mm	(.001 - .003 in)
	Wear limit	0.2 mm	(.008 in)
Piston / cylinder wall clearance	New	0.060 - 0.108 mm	(.0024 - .0043 in)
	Wear limit	0.2 mm	(.008 in)
Cylinder taper (maximum)		0.100 mm	(.004 in)
Cylinder out of round (maximum)		0.080 mm	(.003 in)
Connecting rod big	New	0.39 - 0.74 mm	(.015 - .029 in)
end axial play	Wear limit	1.2 mm	(.047 in)
Crankshaft deflection		MAG side : 0.05 mm (.002 in) ; PTO side : 0.03 mm (.001 in)	
Rotary valve timing	Opening	147° ± 5 BTDC	146.5° ± 5 BTDC
	Closing	65.5° ± 5 ATDC	64° ± 5 ATDC
Rotary valve duration		159°	
Crankcase / rotary valve gap		0.25 - 0.35 mm	(.010 - .014 in)
Connecting rod / crankshaft pin radial clearance	New	0.023 - 0.034 mm	(.0009 - .0013 in)
	Wear limit	0.050 mm	(.002 in)
Connecting rod / piston pin radial clearance	New	0.003 - 0.012 mm	(.00012 - .00047 in)
	Wear limit	0.015 mm	(.00059 in)
ADDITIONAL INFORMATION : Squish gap : 717 engine : 1.3 - 1.7 mm (.051 - .067 in) 787 engine : 1.2 - 1.6 mm (.047 - .063 in)			

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ELECTRICAL		SPX (5877)	XP (5858 / 5859)
Magneto generator output		160 W @ 6000 RPM or 4.0 A @ 2000 RPM	180 W @ 6000 RPM or 5.0 A @ 2000 RPM
Ignition system type		CDI	DC-CDI
Spark plug	Make and type	NGK BR8ES	
	Gap	0.5 - 0.6 mm (.020 - .024 in)	
Ignition timing	mm (in)	2.59 (.102)	3.38 (.133)
(BTDC)	Degrees	20° ± 1 ①	22° ± 1 @ 3500 RPM
Generating coil		40 - 76 Ω	Not applicable
Battery charging coil		0.05 - 0.6 Ω	0.1 - 1 Ω
Trigger coil		Not applicable	190 - 300 Ω
Ignition coil	Primary	Not applicable	0.33 - 0.62 Ω
	Secondary	9 - 15 kΩ	
Engine rev limiter setting		7000 (± 50) RPM	7200 (± 50) RPM
Battery		(Yuasa / Exide) 12 V, 19 A•h	
Fuse	Starting system	5 A	
	Charging system	15 A	15 A (2)
	VTS system	7.5 A	
	Holder relay	Not applicable	5 A
ADDITIONAL INFORMATION : ① Engine cold @ 6000 RPM.			

CARBURETION		SPX (5877)	XP (5858 / 5859)
Carburetor	Type	Mikuni BN-38I (diaphragm)	Mikuni BN-40I (diaphragm)
	Quantity	2	
Main jet		130	142.5
Pilot jet		67.5	70
Adjustment	Low-speed screw	1-1/4 turn ± 1/4	1 turn ± 1/4
	High-speed screw	0	
	Idle speed (in water)	1500 RPM	
	Idle speed (out of water)	3000 RPM	
Fuel	Type	Regular unleaded gasoline	
	Minimum octane no.	87	
Fuel return line orifice		MAG 0.8 mm (.031 in) PTO 0.8 mm (.031 in)	
ADDITIONAL INFORMATION :			

COOLING	SPX (5877)	XP (5858 / 5859)
Type	Open circuit – Direct flow from jet propulsion unit	
Thermostat	None	
Monitoring beeper setting	96-99°C (205-210°F)	
ADDITIONAL INFORMATION :		

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PROPULSION		SPX (5877)	XP (5858 / 5859)
Propulsion system		Bombardier Formula Pump	
Jet pump type		Axial flow single stage	
Impeller rotation (seen from rear)		Counterclockwise	
Transmission		Direct drive	
Coupling type		Crown splines	
Oil type		SEA-DOO JET PUMP SYNTHETIC POLYOLESTER OIL 75W90 GL5	
Steering nozzle pivoting angle		26°	
Trim nozzle pivoting angle		± 8°	
Minimum required water level		90 cm (35 in)	
Drive shaft deflection (maximum)		0.5 mm (.020 in)	
Impeller outside diameter		139.5 mm (5.490 in)	
Impeller / wear ring clearance	New	0.18 - 0.44 mm (.007 - .017 in)	
	Wear limit	1.02 mm (.040 in)	
Impeller shaft end play (new)		0.12 - 0.54 mm (.005 - .021 in)	
Impeller shaft side play		0.05 mm (.002 in)	
Impeller pitch / material		Progressive pitch 11°-24° / stainless steel	Progressive pitch 17°-25° / stainless steel
ADDITIONAL INFORMATION : Do not mix different brands or oil types.			

DIMENSIONS	SPX (5877)	XP (5858 / 5859)
Number of passenger (driver incl.)	2	
Overall length	254 cm (100 in)	
Overall width	105 cm (41.3 in)	
Overall height	92 cm (36.2 in)	
Dry weight	187 kg (412 lb)	197 kg (434 lb)
Load limit (passenger and 10 kg (22 lb) luggage)	160 kg (352 lb)	
ADDITIONAL INFORMATION :		

CAPACITIES		SPX (5877)	XP (5858 / 5859)
Fuel tank		34 L (9 U.S. gal)	
Impeller shaft reservoir	Capacity	90 mL (3.0 U.S. oz)	
	Oil level height	Up to plug	
Oil injection reservoir		4.5 L (1.2 U.S. gal)	
ADDITIONAL INFORMATION :			

PERFORMANCE		SPX (5877)	XP (5858 / 5859)
Estimated pump power		34.9 kW (47.4 hp)	42 kW (57 hp)
Maximum fuel consumption at wide open throttle		35 L/h (9.2 U.S. gal/h)	44.5 L/h (11.7 U.S. gal/h)
Cruising time at full throttle	Fuel tank without reserve	45 minutes	36 minutes
	Fuel tank reserve	9 minutes	7 minutes
ADDITIONAL INFORMATION :			

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MATERIALS	SPX (5877)	XP (5858 / 5859)
Hull	Composite	
Inlet grate	Plastic	
Impeller housing / venturi / nozzle	Plastic / Plastic / Aluminum	
Air intake silencer	Thermoplastic	
Flame arrester	Multi-layer wire screen	
Exhaust muffler	Aluminum	
Steering padding	Thermoplastic elastomer with polystyrene foam	
Fuel tank	Polyethylene	
Oil injection reservoir	Polyethylene	
Seat	Polyurethane foam	
ADDITIONAL INFORMATION :		

STANDARD EQUIPMENT	SPX (5877)	XP (5858 / 5859)
Safety lanyard	Standard	
Tool kit	Standard	
Fuel tank reserve	Standard	
Monitoring beeper	Standard	
Speedometer	Optional	Standard
Multifunction gauge	Standard	
Tachometer	Optional	
Variable trim system (VTS)	Standard	
Reverse	Not applicable	
Storage compartment	Standard	
Rear grab handle	Standard	
Extinguisher holder	Standard	
ADDITIONAL INFORMATION :		

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TIGHTENING TORQUES			SPX (5877)	XP (5858 / 5859)	
ENGINE	Exhaust manifold screw		24 N•m (17 lbf•ft) (4)	40 N•m (30 lbf•ft)	(3) (4)
	Magneto flywheel nut		145 N•m (107 lbf•ft) (1)	105 N•m (77 lbf•ft)	(1)
	Flywheel (PTO side)		110 N•m	(81 lbf•ft)	
	Crankcase screws	M8	24 N•m	(17 lbf•ft)	(3) (4)
		M10	40 N•m	(30 lbf•ft)	(3) (4)
	Crankcase / engine support nuts		35 N•m	(26 lbf•ft)	(1)
	Engine mount / hull		25 N•m	(18 lbf•ft)	(1)
	Cylinder head screws		24 N•m	(17 lbf•ft)	(1) (4)
	Crankcase / cylinder screws		24 N•m (17 lbf•ft) (1) (4)	40 N•m (30 lbf•ft)	(3) (4)
	Tuned pipe flange screws / nut		25 N•m (18 lbf•ft) (1)	40 N•m (30 lbf•ft)	(1)
	Tuned pipe fixation screws		25 N•m	(18 lbf•ft)	(1)
	Flame arrester screws		10 N•m	(88 lbf•in)	(1)
PUMP	Impeller		70 N•m	(52 lbf•ft)	(2)
	Pump / hull nuts		35 N•m	(26 lbf•ft)	(1)
	Venturi / pump housing screws		21 N•m	(16 lbf•ft)	(1)
	VTS ring screws		14 N•m	(10 lbf•ft)	(1)
	Pump housing cover screws		4 N•m	(35 lbf•in)	(1)
	Inlet grate screws		8 N•m	(71 lbf•in)	(1)
	Ride shoe screws		10 N•m	(88 lbf•in)	(1)
STEERING	Cable retaining block bolts		6 N•m	(53 lbf•in)	
	Steering cable / stem arm bolt		3 N•m	(26 lbf•in)	
	Steering stem arm bolts		6 N•m	(53 lbf•in)	
	Handlebar clamp bolts		26 N•m	(19 lbf•ft)	
	Ball joint bolt		7 N•m	(62 lbf•in)	
	Front support bolts		15 N•m	(11 lbf•ft)	(1)
	Rear support / cable bracket bolts		15 N•m	(11 lbf•ft)	(1)
ELECTRICAL	Magneto housing cover screws		9 N•m	(80 lbf•in)	(5)
	Starter mounting screws		22 N•m	(16 lbf•ft)	(1)
	Starter lock nuts		7 N•m	(62 lbf•in)	
	Spark plugs		24 N•m	(17 lbf•ft)	(5)

ADDITIONAL INFORMATION :Apply where indicated ;
(1) Loctite 242 (blue)
(2) Loctite 271 (red)
(3) Loctite 515
(4) Synthetic grease
(5) Anti-seize lubricant

◆ WARNING : Correct torques and use of Loctite must be strictly followed.

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GTS AND GTI MODELS

ENGINE		GTS (5817)	GTI (5865 / 5866)
Engine type		Bombardier-Rotax 587	Bombardier-Rotax 717
Induction type		Rotary valve	
Exhaust system	Type	Water cooled, water injected	
	Water injection fitting (head)	4.6 mm (.181 in)	3.5 mm (.139 in)
	Water injection fitting (cone)	Not applicable	3.5 mm (.139 in)
Starting system		Electric start	
Lubrication	Fuel / oil mixture	VROI (Variable Rate Oil Injection)	
	Oil injection pump	Gear driven	
	Oil type	BOMBARDIER-ROTAX injection oil	
Number of cylinders		2	
Bore	Standard	76.0 mm (2.992 in)	82.0 mm (3.228 in)
	First oversize	76.25 mm (3.002 in)	82.25 mm (3.238 in)
	Second oversize	76.50 mm (3.012 in)	82.50 mm (3.248 in)
Stroke		64 mm (2.520 in)	68 mm (2.68 in)
Displacement		580.7 cm3 (35.4 in3)	718 cm3 (43.81 in3)
Corrected compression ratio		6.5 : 1	6.2 : 1
Cylinder head warpage (maximum)		0.05 mm	(.002 in)
Piston ring type and quantity		1 Semi-Trapez – 1 Rectangular	
Ring end gap	New	0.25 - 0.40 mm	(.010 - .016 in)
	Wear limit	1.00 mm	(.039 in)
Ring / piston groove clearance	New	0.05 - 0.08 mm	0.2 mm
	Wear limit	(.002 - .003 in)	(.008 in)
Piston / cylinder wall clearance	New	0.05 - 0.07 mm (.002 - .003 in)	0.06 - 0.11 mm (.002 - .004 in
	Wear limit	0.2 mm	(.008 in)
Cylinder taper (maximum)		0.100 mm	(.004 in)
Cylinder out of round (maximum)		0.08 mm	(.003 in)
Connecting rod big end axial play	New	0.39 - 0.74 mm	(.015 - .029 in)
	Wear limit	1.2 mm	(.047 in)
Crankshaft deflection		①	
Rotary valve timing	Opening	130° ± 5 BTDC	147° ± 5 BTDC
	Closing	65° ± 5 ATDC	65.5° ± 5 ATDC
Rotary valve duration		147°	159°
Rotary valve / cover clearance		0.25 - 0.35 mm	(.010 - .014 in)
Connecting rod / crankshaft pin radial clearance	New	0.20 - 0.033 mm (.0008 - .0013 in)	0.01 - 0.02 mm (.0004 - .0008 in)
	Wear limit	0.050 mm	(.002 in)
Connecting rod / piston pin radial clearance	New	0.003 - 0.012 mm	(.00012 - .00047 in)
	Wear limit	0.015 mm	(.00059 in)

ADDITIONAL INFORMATION : Squish gap :587 engine : 1.2 - 1.8 mm (.047 - .071 in)
717 engine : 1.3 - 1.7 mm (.051 - .067 in)
① MAG side : 0.05 mm (.002 in)
PTO side : 0.03 mm (.001 in)

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ELECTRICAL		GTS (5817)	GTI (5865 / 5866)
Magneto generator output		160 W @ 6000 RPM or 4.0 A @ 2000 RPM	
Ignition system type		CDI	
Spark plug	Make and type	NGK BR7ES	NGK BR8ES
	Gap	0.5 - 0.6 mm (.020 - .024 in)	
Ignition timing	mm (in)	2.41 (.095)	2.59 (.102)
(BTDC)	Degrees	20° ± 1 ¿	
Generating coil		40 - 76 W	
Battery charging coil		.05 - .6 W	
Ignition coil	Primary	Not applicable	
	Secondary	9 - 15 kW	
Engine rev limiter setting		6550 ± 50 RPM	7000 ± 50 RPM
Battery		(Yuasa / Exide) 12 V, 19 A•h	
Fuse	Starting system	5 A	
	Charging system	15 A	

ADDITIONAL INFORMATION : ¿ Engine cold @ 6000 RPM.

CARBURETION		GTS (5817)	GTI (5865 / 5866)
Carburetor	Type	Mikuni BN-38 (diaphragm)	Mikuni BN-38I (diaphragm)
	Quantity	1	2
Main jet		147.5	130
Pilot jet		65	67.5
Adjustment	Low-speed screw	1-1/4 turn ± 1/4	
	High-speed screw	0	
	Idle speed (in water)	1500 RPM	
	Idle speed (out of water)	2500 RPM	3000 RPM
Fuel	Type	Regular unleaded gasoline	
	Minimum octane no.	87	
Fuel return line orifice		0.8 mm (.031 in)	MAG 0.8 mm (.031 in) PTO 0.8 mm (.031 in)

ADDITIONAL INFORMATION :

COOLING	GTS (5817)	GTI (5865 / 5866)
Type	Open circuit – Direct flow from jet propulsion unit	
Thermostat	None	
Monitoring beeper setting	96-99°C (205-210°F)	

ADDITIONAL INFORMATION :

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PROPULSION		GTS (5817)	GTI (5865 / 5866)
Propulsion system		Bombardier Formula Pump	
Jet pump type		Axial flow single stage	
Impeller rotation (seen from rear)		Counterclockwise	
Transmission		Direct drive	
Coupling type		Crown splines	
Oil type		SEA-DOO JET PUMP SYNTHETIC POLYOLESTER OIL 75W90 GL5	
Steering nozzle pivoting angle		26°	
Trim nozzle pivoting angle		Not applicable	
Minimum required water level		90 cm	(35 in)
Drive shaft deflection (maximum)		0.5 mm	(.020 in)
Impeller outside diameter		139.5 mm	(5.490 in)
Impeller / wearring clearance	New	0.18 - 0.44 mm	(.007 - .017 in)
	Wear limit	1.02 mm	(.040 in)
Impeller shaft end play (new)		0.12 - 0.54 mm	(.005 - .021 in)
Impeller shaft side play		0.05 mm	(.002 in)
Impeller pitch / material		Progressive pitch 10°-25° / stainless steel	Progressive pitch 11°-24° / stainless steel
ADDITIONAL INFORMATION : Do not mix different brands or oil types.			

DIMENSIONS	GTS (5817)	GTI (5865 / 5866)
Number of passenger (driver incl.)	3	3 (5865) / 2 (5866)
Overall length	302 cm	(119.0 in)
Overall width	119 cm	(46.8 in)
Overall height	95 cm	(37.4 in)
Dry weight	210 kg (463 lb)	220 kg (485 lb)
Load limit (passenger and 10 kg (22 lb) luggage)	225 kg	(496 lb)
ADDITIONAL INFORMATION :		

CAPACITIES		GTS (5817)	GTI (5865 / 5866)
Fuel tank		46 L	(12 U.S. gal)
Impeller shaft reservoir	Capacity	90 mL	(3 U.S. oz)
	Oil level height	To bottom of cover hole	
Oil injection reservoir		4.5 L	(1.2 U.S. gal)
ADDITIONAL INFORMATION :			

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MATERIALS	GTS (5817)	GTI (5865 / 5866)
Hull	Composite	
Inlet grate	Plastic	
Air intake silencer	Thermoplastic	
Flame arrester	Multi-layer wire screen	
Exhaust muffler	Aluminum	
Steering padding	Thermoplastic elastomer with polystyrene foam	
Fuel tank	Polyethylene	
Oil injection reservoir	Polyethylene	
Seat	Polyurethane foam	
ADDITIONAL INFORMATION :		

STANDARD EQUIPMENT	GTS (5817)	GTI (5865 / 5866)
Safety lanyard	Standard	
Tool kit	Standard	
Fuel tank reserve	Standard	
Monitoring beeper	Standard	
Electric fuel gauge / low oil warning light	Standard	Not applicable
Multifunction gauge	Optional	Standard
Digitally Encoded Security System (D.E.S.S.)	Optional	Standard
Tachometer	Optional	
Speedometer	Optional	Standard
Variable trim system (VTS)	Not applicable	
Reverse	Standard	
Storage compartment	Standard	
Rear grab handle	Standard	
Extinguisher holder	Standard	
ADDITIONAL INFORMATION :		

PERFORMANCE		GTS (5817)	GTI (5865 / 5866)
Estimated pump power		21.7 kW (29 hp)	34.9 kW (46.8 hp)
Maximum fuel consumption at wide open throttle		22.3 L/h (5.9 U.S. gal/h)	35 L/h (9.3 U.S. gal/h)
Cruising time at full throttle	Fuel tank without reserve	1 hour 42 minutes	1 hour 5 minutes
	Fuel tank reserve	14 minutes	9 minutes
ADDITIONAL INFORMATION :			

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TIGHTENING TORQUES			GTS (5817)	GTI (5865 / 5866)	
ENGINE	Exhaust manifold screws		24 N•m	(17 lbf•ft)	(4)
	Magneto flywheel nut		145 N•m	(107 lbf•ft)	(1)
	Flywheel (PTO side)		110 N•m	(81 lbf•ft)	(5)
	Crankcase screws	M8	24 N•m	(17 lbf•ft)	(3)* (4)
		M10	40 N•m	(30 lbf•ft)	(3)* (4)
	Crankcase / engine support nuts		35 N•m	(26 lbf•ft)	(1)
	Engine support / hull		25 N•m	(18 lbf•ft)	(1)
	Cylinder head screws		24 N•m	(17 lbf•ft)	(1)* (4)
	Cylinder head cover screws (GTS)		9 N•m	(80 lbf•in)	
	Crankcase / cylinder screws		24 N•m	(17 lbf•ft)	(1)** (4)
	Tuned pipe nut		25 N•m	(18 lbf•ft)	(1)
	Tuned pipe fixation screws		25 N•m	(18 lbf•ft)	(1)
	Flame arrester screws		10 N•m	(88 lbf•in)	(1)
PUMP	Impeller		70 N•m	(52 lbf•ft)	(2)
	Pump / hull nuts		35 N•m	(26 lbf•ft)	(1)
	Venturi / pump housing screws		21 N•m	(16 lbf•ft)	(1)
	Nozzle / venturi screws		20 N•m	(15 lbf•ft)	(1)
	Pump housing cover screws		4 N•m	(35 lbf•in)	(1)
	Inlet grate screws		8 N•m	(71 lbf•in)	(1)
	Ride shoe screws		10 N•m	(88 lbf•in)	(1)
STEERING	Steering cable jam nuts		10 N•m	(88 lbf•in)	
	Steering support / collar screws		15 N•m	(11 lbf•ft)	(1)
	Steering stem screw		40 N•m	(30 lbf•ft)	(2)
	Handlebar nuts		26 N•m	(19 lbf•ft)	
	Reverse gate screws		20 N•m	(15 lbf•ft)	(1)
	Steering / cable ball joint nut		7 N•m	62 lbf•in)	
ELECTRICAL	Reverse cable ball joint nut		7 N•m	62 lbf•in)	
	Magneto housing cover screws		9 N•m	(80 lbf•in)	(5)
	Starter mounting screws		22 N•m	(16 lbf•ft)	(1)
	Starter lock nuts		7 N•m	(62 lbf•in)	
	Spark plugs		24 N•m	(17 lbf•ft)	(5)

ADDITIONAL INFORMATION :Apply where indicated ; (1) Loctite 242 (blue)
(2) Loctite 271 (red)
(3) Loctite 515
(4) Synthetic grease
(5) Anti-seize lubricant

* 717 engine only

◆ WARNING : Correct torques and use of Loctite must be strictly followed.

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HX MODEL

ENGINE		HX (5881)
Engine type		Bombardier-Rotax 717
Induction type		Rotary valve
Exhaust system	Type	Water cooled, water injected
	Water injection fitting (head)	3.5 mm (.139 in)
	Water injection fitting (cone)	3.5 mm (.139 in)
Starting system		Electric start
Lubrication	Fuel / oil mixture	VROI (Variable Rate Oil Injection)
	Oil injection pump	Gear driven
	Oil type	BOMBARDIER-ROTAX injection oil
Number of cylinders		2
Bore	Standard	82.00 mm (3.228 in)
	First oversize	82.25 mm (3.238 in)
	Second oversize	82.50 mm (3.248 in)
Stroke		68 mm (2.68 in)
Displacement		718 cm³ (43.81 in³)
Corrected compression ratio		6.2 : 1
Cylinder head warpage (maximum)		0.05 mm (.002 in)
Piston ring type and quantity		1 Semi-trapez - 1 Rectangular
Ring end gap	New	0.25 - 0.40 mm (.010 - .016 in)
	Wear limit	1.00 mm (.039 in)
Ring / piston groove clearance	New	0.025 - 0.070 mm (.001 - .003 in)
	Wear limit	0.2 mm (.008 in)
Piston / cylinder wall	New	0.060 - 0.108 mm (.0024 - .0043 in)
clearance	Wear limit	0.2 mm (.008 in)
Cylinder taper (maximum)		0.100 mm (.004 in)
Cylinder out of round (maximum)		0.080 mm (.003 in)
Connecting rod bigend axial play	New	0.39 - 0.74 mm (.015 - .029 in)
	Wear limit	1.2 mm (.047 in)
Crankshaft deflection		①
Rotary valve timing	Opening	147ø ñ 5 BTDC
	Closing	65.5ø ñ 5 ATDC
Rotary valve duration		159ø
Crankcase / rotary valve gap		0.25 - 0.35 mm (.010 - .014 in)
Connecting rod / crankshaft	New	0.01 - 0.02 mm (.0004 - .0008 in)
pin radial clearance	Wear limit	0.050 mm (.002 in)
Connecting rod / piston	New	0.003 - 0.012 mm (.00012 - .00047 in)
pin radial clearance	Wear limit	0.015 mm (.00059 in)
ADDITIONAL INFORMATION : Squish gap : 1.3 - 1.7 mm (.051 - .067 in) ① MAG side : 0.05 mm (.002 in) PTO side : 0.03 mm (.001 in)		

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ELECTRICAL		HX (5881)
Magneto generator output		160 W @ 6000 RPM or 4.0 A @ 2000 RPM
Ignition system type		CDI
Spark plug	Make and type	NGK BR8ES
	Gap	0.5 - 0.6 mm (.020 - .024 in)
Ignition timing (BTDC)	mm (in)	2.59 (.102)
	Degrees	20ø ñ 1 ?
Generating coil		40 - 76 y
Battery charging coil		.05 - .6 y
Ignition coil	Primary	Not applicable
	Secondary	9 - 15 ky
Engine rev limiter setting		7000 (ñ 50) RPM
Battery		(Yuasa / Exide) 12 V, 19 A•h
Fuse	Starting system	5 A
	Charging system	15 A
	Trim system	Not applicable
ADDITIONAL INFORMATION : ? Engine cold @ 6000 RPM.		

CARBURETION		HX (5881)
Carburetor	Type	Mikuni BN-38I (diaphragm)
	Quantity	2
Main jet		130
Pilot jet		75
Adjustment	Low-speed screw	1-1/2 turn ñ 1/4
	High-speed screw	0
	Idle speed (in water)	1500 RPM
	Idle speed (out of water)	3000 RPM
Fuel	Type	Regular unleaded gasoline
	Minimum octane no.	87
Fuel return line orifice		MAG 0.8 mm (.031 in) PTO 0.8 mm (.031 in)
ADDITIONAL INFORMATION :		

COOLING	HX (5881)
Type	Open circuit - Direct flow from jet propulsion unit
Thermostat	None
Monitoring beeper setting	96-99øC (205-210øF)
ADDITIONAL INFORMATION :	

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PROPULSION		HX (5881)
Propulsion system		Bombardier Formula Pump
Jet pump type		Axial flow single stage
Impeller rotation (seen from rear)		Counterclockwise
Transmission		Direct drive / split FR and RR
Coupling type		Driving claw with rubber cushion
Oil type		SEA-DOO JET PUMP SYNTHETIC POLYOLESTER OIL 75W90 GL5
Steering nozzle pivoting angle		26ø
Trim nozzle pivoting angle		ñ10ø
Minimum required water level		90 cm (35 in)
Drive shaft deflection (maximum)		0.5 mm (.020 in)
Impeller outside diameter		139.5 mm (5.490 in)
Impeller / wearring clearance	New	0.18 - 0.44 mm (.007 - .017 in)
	Wear limit	1.02 mm (.040 in)
Impeller shaft end play (new)		0.12 - 0.54 mm (.005 - .021 in)
Impeller shaft side play		0.05 mm (.002 in)
Impeller pitch / material		Progressive pitch 11ø-24ø / stainless steel
ADDITIONAL INFORMATION : Do not mix different brands or oil types.		

DIMENSIONS		HX (5881)
Number of passenger (driver incl.)		1
Overall length		273 cm (107.5 in)
Overall width		85 cm (33.5 in)
Overall height		97 cm (38.2 in)
Dry weight		177 kg (390 lb)
Load limit (passenger and 10 kg (22 lb) luggage)		110 kg (250 lb)
ADDITIONAL INFORMATION :		

CAPACITIES		HX (5881)
Fuel tank		27 L (7 U.S. gal)
Impeller shaft reservoir	Capacity	90 mL (3.0 U.S. oz)
	Oil level height	To bottom of cover hole
Oil injection reservoir		4.0 L (1.0 U.S. gal)
ADDITIONAL INFORMATION :		

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MATERIALS	HX (5881)
Hull	Composite
Inlet grate	Aluminum
Impeller housing	Plastic
Air intake silencer	Thermoplastic
Flame arrester	Multi-layer wire screen
Exhaust muffler	Aluminum
Steering padding	Thermoplastic elastomer with polystyrene foam
Fuel tank	Polyethylene
Oil injection reservoir	Polyethylene
Seat	Polyurethane foam
ADDITIONAL INFORMATION :	

STANDARD EQUIPMENT	HX (5881)
Safety lanyard	Standard
Tool kit	Standard
Fuel tank reserve	Standard
Monitoring beeper	Standard
Electric fuel gauge /low oil warning light	Optional
Multifunction gauge	Optional
Tachometer	Optional
Manual trim system	Standard
Reverse	Not applicable
Storage compartment	Not applicable
Rear grab handle	Standard
Extinguisher holder	Standard
ADDITIONAL INFORMATION :	

PERFORMANCE		HX (5881)
Estimated pump power		34.9 kW (46.8 hp)
Maximum fuel consumption at wide open throttle		33 L/h (8.7 U.S. gal/h)
Cruising time at full throttle	Fuel tank without reserve	35 minutes
	Fuel tank reserve	10 minutes
ADDITIONAL INFORMATION :		

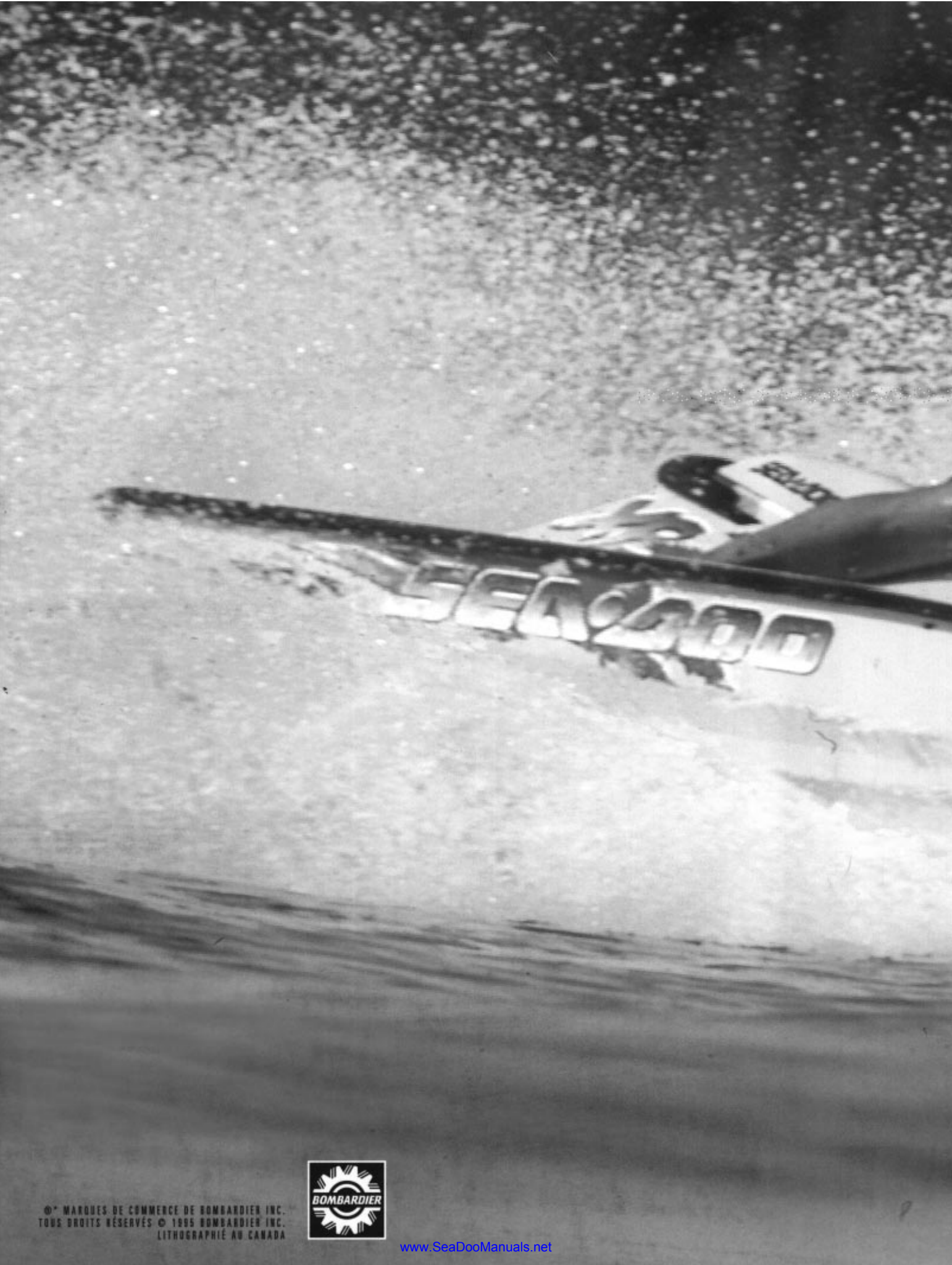
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TIGHTENING TORQUES			HX (5881)		
ENGINE	Exhaust manifold screw		24 N•m	(17 lbf•ft)	(4)
	Magneto flywheel nut		145 N•m	(107 lbf•ft)	(1)
	Flywheel (PTO side)		110 N•m	(81 lbf•ft)	
	Crankcase screws	M8	24 N•m	(17 lbf•ft)	(3) (4)
		M10	40 N•m	(30 lbf•ft)	(3) (4)
	Crankcase / engine support nuts		35 N•m	(26 lbf•ft)	(1)
	Engine support / hull		25 N•m	(18 lbf•ft)	(1)
	Cylinder head screws		24 N•m	(17 lbf•ft)	(1) (4)
	Crankcase / cylinder screws		24 N•m	(17 lbf•ft)	(1) (4)
	Tuned pipe nut		25 N•m	(18 lbf•ft)	(1)
	Tuned pipe fixation screws		25 N•m	(18 lbf•ft)	(1)
	Flame arrester screws		10 N•m	(88 lbf•in)	(1)
PUMP	Impeller		70 N•m	(52 lbf•ft)	(2)
	Pump / hull nuts		31 N•m	(23 lbf•ft)	(1)
	Venturi / pump housing screws		21 N•m	(16 lbf•ft)	(1)
	VTS ring screws		14 N•m	(10 lbf•ft)	
	Pump housing cover screws		4 N•m	(35 lbf•in)	(1)
	Inlet grate screws		8 N•m	(71 lbf•in)	(1)
	Ride shoe screws		10 N•m	(88 lbf•in)	(1)
STEERING	Cable retaining block bolts		6 N•m	(53 lbf•in)	
	Steering cable / lever		3 N•m	(26 lbf•in)	
	Steering stem arm bolts		6 N•m	(53 lbf•in)	
	Handlebar clamp bolts		26 N•m	(19 lbf•ft)	
	Ball joint bolt		7 N•m	(62 lbf•in)	
	Steering support bolts		15 N•m	(11 lbf•ft)	
	Lever pivot bolt		6 N•m	(53 lbf•in)	
ELECTRICAL	Magneto housing cover screws		9 N•m	(80 lbf•in)	(5)
	Starter mounting screws		22 N•m	(16 lbf•ft)	(1)
	Starter lock nuts		7 N•m	62 lbf•in)	
	Spark plugs		24 N•m	(17 lbf•ft)	(5)

ADDITIONAL INFORMATION : Apply where indicated ;(1) Loctite 242 (blue)
(2) Loctite 271 (red)
(3) Loctite 515
(4) Synthetic grease
(5) Anti-seize lubricant

◆ WARNING : Correct torques and use of Loctite must be strictly followed.

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